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MOOSE HUNTING ACTIVITY IN NORTHERN ALBERTA:

A CASE STUDY IN WILDLIFE ECONOMICS

by



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A THESIS

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The undersigned certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled "Moose Hunting Activity in Northern Alberta: A Case Study in Wildlife Economics," submitted by William Stanley Pattison in partial fulfilment of the requirements for the degree of Master of Science.

ABSTRACT

In recent years there has been a sharp increase in resident and non-resident moose hunting activity in Big Game Zone 1 of Northern Alberta. Support of such activity requires land resources that could be devoted to alternative uses. Costs arise not only from necessary wildlife development and management functions but also from preclusion of benefits of alternative uses of the resources. Optimum allocation of land resources among alternative use patterns, of which moose is one component, necessitates determination of net social benefits from each alternative in order to compare the economic merits of these alternatives.

This thesis presents measures of net social benefits currently derived from the moose resources of Big Game Zone 1 through hunting activity and the economic impact of this activity on Northern Alberta and the Province as a whole. Further, the ability of the moose resource to withstand an increase in hunting activity is examined. Future hunter participation is projected with particular emphasis on the geographical distribution of potential hunting activity within Zone 1 in relation to available harvestable moose populations.

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CHAPTER I

INTRODUCTION

Purpose

Public policy decisions regarding wildlife resource propagation and utilization for recreation have often been made without the assistance of basic economic information. The purpose of this study is to provide a basis for such public policy decisions, through development of economic concepts relevant to resource use in general and utilization of one species of wildlife in a defined region of Alberta in particular. Major emphasis is placed on development of criteria to facilitate evaluation and comparison of wildlife production and alternative land resource uses. This development is prerequisite to determination of the optimum state of conservation.¹

Context of the Problem

Historically the principal task of wildlife administrators in Alberta has been to regulate the exploitation of existing wildlife populations by policing. Recently there

¹ Infra., Page 13.

has been increasing awareness of the need to broaden the task to include wildlife management. Faced with increasing activity by recreationists and with decreasing availability of wildlife habitat due to human population and industrial growth, administrators are finding they must take measures to conserve remaining wildlife and wildlife habitat. Game animals are recognized as valuable products, the production of which must compete for the use of limited available land resources. The optimum use pattern of this land depends upon its ability to satisfy the wants and needs of society over time.

When a product is disposed of via an efficient market mechanism, the prevailing price less per unit costs provides an accurate evaluation of the returns to that particular land use. However, many natural resources such as wildlife support outdoor recreation benefits that are traditionally provided free, or almost free, to users. This situation presents game managers with a complex problem in delineating the contribution of wildlife to society's welfare.

The province of Alberta continues to experience a significant and increasing demand for its wildlife by both resident and non-resident hunters. "In 1957, the Fish and Wildlife Division sold 101,971 game licenses as compared to

209,879 in 1967, an increase of over 100 percent."¹ A recent development illustrates specifically the increasing interest of non-resident hunters in Alberta Big Game Zone 1 moose.

Late in August, 1967 advertisements were placed in nine newspapers in northwestern United States, drawing to the attention of American hunters that a new \$25 license was available for non-resident hunters....Response was immediate and heavy. During the month of September alone, over 10,000 inquiries were received. In total, more than 20,000 inquiries were processed and 9,927 licenses eventually were sold during the open season from September 1st to December 16th, 1967.²

During the 1967 season non-resident moose hunters were permitted to hunt in Big Game Zone 1 without a licensed guide, if they were unable to obtain one. (There were an insufficient number of guides to serve all non-resident hunters.) In 1968 an ample number of guides were licensed, and non-resident hunters were compelled without exception to be accompanied by at least one guide for every two hunters. The hunting license fee was doubled to \$50 and there was no advertising. In spite of these restrictions over 4,300 Americans hunted moose in Zone 1 during the 1968 season.³

¹ V.A. Wood, "Alberta's Public Lands," Alberta: Lands-Forests-Parks-Wildlife, XII, No. 1 (1969), 18.

² S.B. Smith, "Non-resident Moose Hunting in Alberta-1967," Alberta: Lands-Forests-Parks-Wildlife, XI, No. 1 (1968), 34.

³ For a geographical description of Big Game Zone 1 see Page 5.

In addition, over 20,000 Alberta residents hunted moose in the zone during the same season. Considerable land and habitat resources are required to support hunting activity of this magnitude. Social costs are associated with the utilization by moose of habitat and other land resources. These costs arise directly from wildlife development and management programs and indirectly from preclusion of other uses and their associated benefits. Optimum allocation of Zone 1 land resources among alternative use patterns, of which production of moose is one component, necessitates determination of social net benefits for each alternative in order to compare the economic merits of these alternatives. Clear enumeration and evaluation of benefits and costs to society associated with moose propagation and utilization in Zone 1 require the combined expertise of biologists and economists.

Objective and Plan of Study

The objectives of the study are (a) to evaluate the contribution of Big Game Zone 1 moose resources to society in general and to the economies of Alberta and Northern Alberta in particular, and (b) to determine the direction of future utilization of moose resources in the zone, consistent with the objective of conservation policy.¹ The plan of study

¹ Infra., Page 14.

stems from these objectives.

The rationale for the need and use of specific ecologic and economic data required to meet the objectives of the study is explained in Chapter II. The data are presented in the next chapter, together with a description of data collection methods. The actual evaluation of Zone 1 moose hunting activity is carried out in Chapter IV, and the potential for expanding moose hunting activity in the zone examined in Chapter V. The study as outlined here and beginning with Chapter II is preceded by a description of the Study region.

Description of the Study Region

Big Game Zone 1 constitutes about 45 percent of the area of Alberta (see maps of the zone--Figures 1 and 2 on pages 78 and 79, respectively). Its southern boundary runs eastward from the British Columbia border, following approximately the 62nd township line to the Forestry Trunk Road, south on this road to the Berland River and downstream to the Athabasca River. The boundary follows the Athabasca River downstream to the town of Athabasca, at which point it leaves the river and proceeds generally eastward to the town of Lac La Biche, then southward to the Amisk River. Following the Amisk to the Beaver River, it continues eastward along the Beaver to the Saskatchewan border. With the

exception of approximately 195 townships in the Grand Prairie region (Big Game Zone 2), 56 townships in the Cold Lake Air Weapons Range, and 375 townships in Wood Buffalo National Park, the western, northern, and eastern boundaries are formed by British Columbia, the Northwest Territories and Saskatchewan, respectively. The total area of the Zone is estimated at 110,000 to 120,000 square miles and contains approximately 105,000 square miles of moose habitat.

Focus of the study is on direct moose hunting activity taking place within Zone 1.¹ The Zone is one of fourteen big game management zones in Alberta for which boundaries are defined by the Alberta Fish and Wildlife Division for the purpose of formulating and administering game management policy. The boundaries do not correspond to regions of economic activity. Therefore, aside from direct hunting activity, the study region is expanded to include all of Northern Alberta and defined as that area of the province lying north of Highway No. 16, excluding the City of Edmonton (Figure 1).²

The expanded study region, hereafter referred to as

¹ Big Game Zone 1 is hereafter referred to as Zone 1.

² Direct moose hunting activity refers only to actual stalking of moose. Activities prior to and after direct activity may or may not take place within Zone 1.

"Northern Alberta," is largely homogeneous with respect to economic activity. Most of the region consists of publicly owned land. Employment is largely based upon primary extraction and production industries such as forestry, petroleum, agriculture, and fisheries. Much of the region is characterized by low incomes. No major industrial centres are located in the area. Almost all manufactured inputs and final products used in Northern Alberta are obtained from or through Edmonton. Large portions of the region are inaccessible by normal means of transportation.

Approximately 219,000 people or 15 percent of the province's population reside in Northern Alberta.¹ Only 18 percent of these people reside in cities or towns of 3,000 people or more. Grande Prairie, with a population of 11,417, is the only city.

Northern Alberta is part of the Arctic drainage basin except for the southeastern portion drained by the North Saskatchewan River System. That portion of the Mackenzie River system within the region includes the Peace, Athabasca, and Hay rivers. Elevation drops generally in a northeasterly

¹ The Dominion Bureau of Statistics publishes population data by Census Divisions. However, as Census Division boundaries do not coincide with the boundaries of the defined study region, the estimate of the population is obtained through extrapolation of Census data.

direction from 2,190 feet above sea level at Grande Prairie to 714 feet at Fort Chipewyan. Grey wooded soils predominate the entire area. Mean annual precipitation varies from 12.26 inches at Peace River to 19.62 inches at Cold Lake. Maximum July mean daily temperatures are in the seventies. As these figures show, average summer weather conditions of temperature and precipitation are not unfavorable to agricultural production. However, extreme deviations such as late spring and early fall frosts increase the risk associated with crop production.¹

Lake Athabasca, Lesser Slave Lake, Lac La Biche, and Cold Lake are some of the lakes important for commercial fishing. These and other lakes and streams are popular sport fishing and recreation areas. A wide variety of wildlife species are found in Northern Alberta. Many species of migratory waterfowl such as swans, cranes, geese and ducks, nest in and/or migrate through Northern Alberta. Four species of upland game birds are native to the region: Willow ptarmigan, Spruce grouse, Ruffed grouse, and Sharptail grouse. Two non-native species of upland game birds are found in Northern Alberta: Hungarian partridge and, to a lesser extent, Ring-necked pheasant. Big game species include Mule deer, White-tailed deer, moose, Woodland caribou,

¹ Alberta Bureau of Statistics, Alberta Industry and Resources 1968 (Edmonton: Queen's Printer, 1968), pp. 6-7.

Barren Ground caribou, Grizzly bear, Black bear, and, in Wood Buffalo National Park only, bison.

Moose are the predominant big game species in the region. Biologists estimate the Zone 1 moose population at approximately 65,000. They are browsers, with a diet consisting mainly of willow, birch, poplar, and other woody and shrub-type vegetation as well as water plants during summer. Predators such as wolves and phenomena such as forest fires are natural factors that control moose population increases and subsequent habitat damage. To a considerable extent these and other natural forces have been curbed by man. If left without further management by man, moose populations could increase to a point at which they would exhaust available browse and starve. Reported overbrowsing in some areas of Zone 1, coupled with a generally low fecundity rate of the moose population, suggests a potential harvest of moose in the Zone, somewhat beyond current levels. However, the question of long-run optimum harvest rates, while preconditioned by ecologic factors, is posed as an economic question in an institutional framework.

CHAPTER II

CONCEPTUAL FRAMEWORK

Introduction

Profit-maximizing firms endeavor to allocate resources to those activities that produce the greatest profit to the firm. Similarly public decision-makers seek to allocate resources to uses resulting in the greatest net social benefit, including both pecuniary and non-pecuniary elements.

Resources may be thought of as inputs into the social production process, the result of which is social benefit. Associated with the use of each input is a social cost. Like profit maximizing firms, the public seeks to use resources in the production process until the marginal cost of each input equals its marginal value product, i.e. until the cost of the last unit of input equals the value of the product it produces. Therefore, knowledge of factor prices and factor productivity is prerequisite to efficient allocation of resources. Of the three classical groups of production factors--land, labor and capital--various types of land or natural resources usually present the greatest difficulty in determining factor prices and productivity. Because publicly owned resources often include specific resources that present

difficulty in evaluation (for example, scenic phenomena of nature), the process of efficient allocation of public resources is often frustrated.

The present study is concerned with the use of a specific public resource that is difficult to evaluate--moose. In this chapter, moose are placed in perspective within the general classification of natural resources. The theory of conservation of natural resources in general, and of that group of natural resources comprising wildlife in particular, is reviewed, followed by a discussion of the benefits and costs of wildlife resources when used as inputs in the social production process.

Natural Resource Classification¹

Natural resources may be divided into two subclasses; nonrenewable or "stock" resources and renewable or "flow" resources. Stock resources are those of which the total physical quantity does not increase significantly over time, such as the oil reserves of Zone 1. In an absolute sense, any rate of use actually depletes the

¹ A more complete classification of resources is given in the following reference, upon which the present discussion is based: S.V. Ciriacy-Wantrup, Resource Conservation Economics and Policies, 3rd ed. (Berkeley: University of California Press, 1968), Chapter 3.

available quantity of stock resources and diminishes their potential use rate at some future time.

Flow resources, on the other hand, become available over successive time intervals. These resources may be further subdivided into (a) those for which future flows are unaffected by present human intervention and (b) those for which future flows are affected by present human intervention. Wildlife, and particularly big game species such as moose, are typical of resources for which future flows may be significantly increased or decreased by present human action. These flow resources may be divided into two subclasses: those characterized by a "critical zone" and those with no such zone. In the flow of resources without a critical zone a decrease caused by human action is reversible at any time and place. The rate of flow of the resource may be decreased to zero by human intervention in any time interval without economically precluding an increased flow in future intervals. With others, however, there exists a critical zone beyond which further decrease in flow caused by human action cannot be halted or reversed economically or, in some situations, biologically. A sufficient minimum flow must remain after human use to insure future resource availability. The moose species is clearly a critical zone flow resource. Moreover, moose are

dependent upon natural habitat, itself a flow resource with a critical zone.

The existence of a critical zone for both moose and the habitat on which they depend emphasizes the importance of knowledgeable management of these resources. If either the habitat or the species is utilized at a rate in excess of the respective critical zone, biologically, and particularly economically irreversible depletion of the resource may develop. The optimum rate at which to utilize these resources must be determined. Conservation policy deals with optimum rates of resource utilization.

Conservation of Natural Resources

"Conservation" is the cry of many special interest groups. As such, the term often loses its meaning in a shroud of emotionalism. Indeed the users themselves sometimes appear unsure of what they mean, as revealed in such vague definitions as "wise use." Many other definitions have been advanced offering little practical improvement.

The concept of conservation used in this study is that developed by Ciriacy-Wantrup, who defines resource conservation in the context of the "when" of use.

"...conservation and its logical collary but economic opposite, depletion, are defined in terms of changes in the intertemporal distribution of physical rates of use. In conservation, the redistribution of use is in the direction of the future; in depletion, in the direction of the present."¹

A similar view to Wantrup's is held by Scott who says that "a conservation is a public policy which seeks to increase future usable supplies of a natural resource by present actions."²

Conservation is defined as a redistribution of the rate of use of a resource in the direction of the future. Any given distribution of use rates is some state of conservation. The problem of conservation policy is to determine the optimum state, or the temporal distribution of rates of resource use that will produce the maximum present value of the flow of net benefits for the planning period.

Establishment of an objective for conservation policy is assisted by recognition of the principle,

¹ S. V. Ciriacy-Wantrup, op. cit., p. 51.

² Anthony Scott, Natural Resources: The Economics of Conservation (Toronto: University of Toronto Press, 1955). p. 18.

sometimes reluctantly accepted by individual resource managers, that natural resources must not be managed primarily for the benefit of the resources themselves, but for society, both present and future. Different land use patterns involve varying temporal distributions of social costs and benefits. The objective of conservation policy, recognized in this study, is the maximization of social benefits net of social costs over the planning period.¹ Future net benefits are discounted to their present value. The validity of resource use decisions based upon the objective of maximizing social net benefits rests upon the accuracy with which benefits and costs relevant to all alternative uses are enumerated and evaluated. Unlike private decision-makers public planners must attempt to measure all social benefits and costs regardless of who receives or pays them.

The first step in the evaluation of a particular existing alternative is determination of the net social benefits currently resulting from that use. The criterion for deciding whether or not the alternative is economically feasible at its present use rate is that gross social benefits must equal or exceed gross social costs. The next step is to look at the effect of incremental changes in use

¹ S.V. Ciriacy-Wantrup, op. cit., p. 230.

rates for an indication of the direction of change (if any) required to reach the optimum state of conservation for that particular resource use. For example, if a specified increase in moose hunting activity yields greater social benefits than the social costs incurred, then an expansion in hunting activity is the change required to increase net benefits. The optimum state of conservation for that particular use of resources will be reached (net social benefits maximized) when the marginal social costs incurred by expansion equal the marginal social benefits received.

The nature of benefits and costs relevant to the use of public resources presents specific problems in reaching decisions regarding optimum use patterns of these resources. Social benefits and costs may include extra-market values, where the social value of a commodity is not fully reflected in the market. An example of a commodity that may possess extra-market value is wildlife. Such values are not often explicitly considered by private agencies. However, they must be considered by public planners.

In the absence of a competitive market mechanism there are no adequate price-indicators of consumers' demonstrated willingness to pay for resources with extra-market values. If benefit-cost criteria are to be used for public land use decisions, these values must be estimated. The

value or benefit of a commodity is established by estimating how much consumers would be willing to pay if the commodity were competitively marketed. The necessity of estimation, with its accompanying risk of inaccuracies and subjective bias, does not remove the need for evaluation but rather emphasizes the importance of the knowledge and objectivity with which such evaluations are made.

The objective and criteria of conservation policy relating to natural resources offer guidelines for particular resource use evaluations. A primary requirement for efficient resource allocation consistent with conservation policy is the enumeration and evaluation of social benefits and costs associated with specific alternatives. Against this background, the use of wildlife, a flow resource with a critical zone, is considered along with a framework for identifying and measuring social benefits and costs associated with wildlife management on public land for the accommodation of sportsmen.

Evaluation of Big Game Hunting Activity

To ensure survival of a given species on given range, sufficient flow of the resource must be maintained to continually replenish the breeding stock. Flows in excess of this requirement may be harvested with no detrimental

effect on the species population. Such a harvest, provided it does not slow the rate of flow of the resource beyond the critical zone, will not preclude the potential rates of flow in future time intervals. Indeed it may even increase that potential. Controlled harvesting of excess wildlife populations is a universally recognized tool of game management, the objective being maintenance of a viable population with efficient and sustained utilization of habitat.¹

Definition of the critical zone depends upon herd characteristics such as health, age, sex ratio as well as of the habitat or range. Such definition requires accurate knowledge of biological relationships. Some of the determining factors--climatic conditions, for example--are at best uncertain. When specifying the critical zone, planners must recognize the uncertainty factor to avoid any human action that would decrease the replenishing flow of wildlife beyond the point where it is economical to halt and reverse the depletion. Ciriacy-Wantrup call this procedure the maintenance of a "safe minimum standard of conservation." The primary objective of a safe minimum

¹ While the maintenance of wild animal population in a healthy, vigorous, and stable condition with high fecundity is an objective of game management per se, it may not be considered one of overall land use policy. As pointed out earlier, the value of wildlife lies only in its ability to satisfy the wants and needs of people.

standard is not the maintenance of any particular use rate but rather the maintenance of the "economic possibility of halting and reversing a decrease of flow and use."¹

A specific criticism of the use of traditional benefit-cost analysis in reaching decisions regarding conservation of resources such as wildlife and unique phenomena of nature is appropriate to the discussion of a safe minimum standard. Krutilla argues that (a) our rising level of technology tends to give less dependence on natural resources in the production of goods over time and (b) due to expanding urban pressure association with natural phenomena tends to produce increasing utility over time. Because of these two factors the present use of natural resources may proceed further than it really should. Moreover, because of instances of irreversibility, the level of well-being attainable in the future will not be as high as if a higher state of conservation had been followed in the past.² The consequences of present actions suggested by Krutilla may be avoided to some extent by specifying a safe minimum standard of conservation somewhat higher than present conditions only would dictate.

¹ S.V. Ciriacy-Wantrup, op. cit., p. 254.

² John V. Krutilla, "Conservation Reconsidered." American Economic Review, LIX (1967), 777-786.

Within the confines of a safe minimum standard constraint, biologists can estimate the rate at which surplus flows of a given species on given range can be harvested by humans. Conservation policy is concerned with whether or not provision for such harvest is in the public interest. Determination of the optimum harvest rate is a further problem of conservation policy. Management of wildlife on public land uses funds that, along with the land resources, could be devoted to alternative uses. Given maximization of the present value of net social benefits as the main objective of public land use decisions, benefits and costs associated with game management must be carefully delineated and compared with benefits and costs of alternative land uses.

Benefits of Big Game Hunting Activity.

Both primary and secondary benefits are derived from big game hunting activity.

Primary benefits--The problem of determining the value of game resources to the hunter is complex for two reasons:

1. The resource is not purchased by itself as is, for example, a single piece of equipment. Rather, in the process of hunting, the hunter purchases an array of goods and services, only one of which is the actual privilege to hunt wildlife.
2. The hunter is prevented by the market mechanism from registering his estimation of the worth of the resource.

That is, he is often prevented by constraints such as limited leisure time and the number of animals he may kill, from expanding his "consumption" of hunting to the point where the marginal utility derived is equal to the marginal cost or license fee. In essence the question is, "what is the true value to the consumer of one component of a purchased bundle of goods when that component is purchased at a lower price than would prevail in a competitive market?"

The method proposed in this study for evaluating game resources rests upon the following assumptions.

1. The value to the hunter of his total hunting experience equals or exceeds the cost of the complete "bundle" of goods and services he purchases for hunting.
2. All but one component of this product-mix is purchased in a competitive market. Their utility to the hunter is therefore assumed equal to their cost. The one exception is the game resource itself, i.e. the privilege of actually hunting the animals. For this resource, the hunter pays a standard license fee which may only reflect part of the value of the resource.
3. Each hunter receives at least as much utility from his hunting experience as it cost him. In addition, some receive benefits in excess of their incurred costs.
4. All such extra-market benefits may be attributed to the

game resource as it is the only component of the total "bundle" of goods and services for which the hunter did not pay a full market price.

On the basis of these assumptions, the value of the game resource to the hunter is established as the sum of the license fee plus any extra-market benefits the hunter receives from his total experience.

The implications of violation of assumption two should be pointed out. For example, the cost of guiding services may exceed the utility derived from guiding. If so, the hunter will indicate receipt of less extra-market benefits from his experience than he would if the marginal cost of all goods and services were, in fact, equal to their marginal revenue. Therefore, the particular good or service for which marginal cost exceeds marginal revenue would appropriate some of the extra-market value that should be attributed to the wildlife resource. The net effect is an underestimation of the value of the wildlife resource. Alternatively if the cost of some good or service is less than the utility derived, then the extra-market value that should be attributed to this good or service is appropriated by the wildlife resource and overevaluation results. In the case with which this study is concerned, there is little evidence that assumption two does not hold. With the

exception of guiding, all goods and services are offered for sale to the hunters on a voluntary basis and in competition with substitutes. Furthermore, while the purchase of guiding services is compulsory, the large number of available guides helps to ensure the charging of fees commensurate with services provided.

The estimation of extra-market benefits is probably the most difficult problem facing evaluators of outdoor recreation. However, the ever increasing need for such evaluation has instigated considerable effort in refinement of analytical techniques of estimation. Generally research in this field has developed in two directions. One approach is direct.¹ That is, individual recreationists are asked how much they would be willing to pay for the recreational opportunity. The major criticism of the direct technique of evaluation is in the practical difficulty of obtaining reliable and consistent answers to hypothetical questions.

¹ Applications of the direct method of evaluation are reported in the following works: Robert K. Davis, "The Value of Big Game Hunting in a Private Forest," in Transactions of the Twenty-Ninth North American Wildlife and Natural Resources Conference, (Washington, D.C.: Wildlife Management Institute, March 1964), pp. 393-403; and William E. Phillips, "Regional Development of Owens Valley, California: An Economic Base Study of Natural Resources" (unpublished Doctoral Dissertation, University of California, Berkeley, 1967).

The alternative approach attempts to estimate indirectly recreationists' willingness to pay on the basis of their observed behavior. Estimation involves stratifying the recreationists into groups defined by hypothesized similarity of preference for money versus recreation. The manner of stratification varies considerably from that of one stratum for the whole population (Hotelling-Clawson) to one of differentiating on the basis of income (Pearse).¹ Within each stratum, all individual units of recreation (usually a visitor-day) are assumed to be worth an equal amount to the consumers. The next step in the technique is to determine certain specific costs (the major part or all of which are travel costs) incurred by the recreationists in gaining access to the recreational opportunity. The marginal buyer of recreation is then arbitrarily identified. The technique of identification varies with specific methods. The

¹ For a detailed explanation of the underlying concepts of some current indirect techniques, the reader is referred to a letter from Harold Hotelling to the Director of the United States National Parks Service (dated 1947), quoted in Economic Studies of Outdoor Recreation, Study Report No. 24, (Washington D.C.: Outdoor Recreation Resources Review Commission, 1962), p. 56; Andrew H. Trice and Samuel E. Wood, "Measurement of Recreation Benefits," Land Economics (August 1958), 195-207; Marion Clawson, "Methods of Measuring the Demand for and Value of Outdoor Recreation" Reprint No. 10, (Washington D.C.: Resources for the Future Inc., Feb. 1959); and Peter H. Pearse, "A New Approach to the Evaluation of Non-priced Recreational Resources," Land Economics, XLIV (Feb. 1968), 87-99.

Hotelling-Clawson methods identifies the marginal buyer as the individual whose travel costs equal the average of those of visitors from the farthest distant zone while, for the Trice-Wood method, the marginal buyer is the individual whose travel costs equal the ninetieth percentile. As all recreationists within each stratum consume an identical product yet incur varying costs for it, some of them receive "consumers' surplus" equal to the difference between their incurred costs (determined as above) and those of the marginal buyer. By plotting estimated consumers' surplus against visitor days, a demand schedule for the recreational opportunity is drawn.

While indirect methods do not encounter the practical difficulties associated with direct methods, they are dependent upon certain implicit assumptions. The problems posed by some of the more critical assumptions common to currently advanced indirect techniques are discussed below.

First, the approach implies the ability to define groups of recreationists with homogeneous preferences for money and recreation. Second, the homogeneity of recreational units is implied. These two assumptions are essential to the subsequent reasoning that all recreationists within a specified group would be willing to pay an equal amount for a marginal unit of recreation. The value to the individual of a recreation day is subject to a great many factors in addition to

the costs incurred. Such factors include weather conditions, amicability of companions, population pressure, and so on. These are qualitative factors whose effect is directly influenced by the preferences of the individual. A person who spends more by way of total costs, including access costs, may do so specifically in order to consume a more valuable product. The value of the product he buys cannot necessarily be equated to that consumed by someone who did not spend so much. Further, the fact the individual acted in this way indicates preference for a different quality of recreational experience. In summary, a recreation day is an extremely variable package. Its value to people with differing preferences cannot be easily approximated by associated costs. In light of this fact the above two assumptions may be seriously questioned.

A third assumption of the indirect approach is that recreationists will respond to an increase in toll in the same way they would to an equal increase in other access costs. Issue is taken with this assumption on the following basis. Travel costs make up the major portion of access costs and are positively related to distance from the recreational site. Lessinger points out that recreational facilities are

usually located away from metropolitan centres.¹ Whatever the reason for people locating near the recreational facilities, they are actually paying for their recreational accessibility. The price is urban inaccessibility. If the toll for recreation was raised differentially so that everyone's price (access costs plus toll) equalled the access costs of the high cost users, then, in effect, those living near would have to pay high access costs to both recreational facilities and urban centres. Thus benefits measured in such a way would tend to be too high.

The foregoing is not an exhaustive critique of current analytical techniques of evaluation. It is intended rather to point out those assumptions and characteristics that are deemed crucial to the validity of alternative methods and that influenced the choice between alternatives to be used for the present study. Simplicity is important, but it must not be obtained at the expense of relevance. Hines, in his criticism of the Trice-Wood method, says,

"What is needed to appraise such recreational benefits is a way to discriminate between various users and to sum up the different individual evaluations--not to assume an artificial constancy of reaction."²

¹Jack Lessinger, "Measurement of Recreation Benefits: A Reply," Land Economics, XXXIV (1958), 369-370.

²Lawrence G. Hines, "Measurement of Recreation Benefits: A Reply," Land Economics, XXXIV (1958), 365-367.

All of the indirect methods assume a considerable degree of constancy of reaction. A direct method is the only technique that will produce individual evaluations on the basis of varying qualitative aspects of recreation and preferences of recreationists. For this reason the present study utilizes a direct method of evaluation. The practical difficulties in obtaining reliable answers to direct but hypothetical questions are considered more easily mastered than those inherent in the assumptions underlying indirect techniques.

Secondary benefits--Because of the diminishing marginal utility of money, a redistribution of income may produce a net change in social welfare. The direction of the change depends upon the nature of the redistribution, i.e. toward higher or lower income regions. In addition, a dollar spent in one region or sector of the economy may not produce secondary effects of the same magnitude as one spent in another region or sector. This study does not attempt to measure the effect of these two factors on Alberta moose hunter expenditures. Secondary benefits accruing to certain sectors of the economy through sale of goods and services to hunters therefore are not included in evaluating moose hunting activity to society in general. To the extent that hunters would have spent the money on some other activity had they

not spent it on hunting, such expenditures are assumed to represent a sectoral or regional transfer of income with no net social change taking place.

However, from the viewpoint of Alberta and of Northern Alberta, secondary benefits arising in this way are included in the evaluation. They provide an indication of impact upon the income of these regions from the spending of non-resident hunters. Through questionnaires information is obtained from non-resident hunters regarding their regional expenditures, giving an estimate of the direct increase in sales of regional selling agencies as a result of the hunting activity.¹ However, such an estimate omits two important considerations: 1. Indirect increases in sales. Some industries from which purchases are made increase their purchases from other regional industries as a result. 2. Leakages. Some of the goods purchased are imported and do not represent output of industries within the local economy. Others are produced in the region but require imported inputs. Appropriate adjustments to actual hunter expenditures must be made to account for these factors if the full impact

¹ "Residents" here refers only to those people residing within the defined region. All those residing outside the region (even if they are residents of the province) are called non-residents.

on all regional industries is to be reliably established. An impact multiplier is needed to apply to first-round expenditures.

This study employs Input-Output analysis to determine the impact of non-resident hunter expenditures on the Alberta economy.¹ However, insufficient data are currently available for Northern Alberta. If leakages due to imports are higher from the economy of Northern Alberta than from that of Alberta as a whole (as is suspected but not substantiated in this study), the impact multiplier calculated for the province should not be applied to the northern region. To compensate for the suspected larger volume of imported goods, the expansionary effect of each dollar of non-resident hunter expenditures in Northern Alberta is arbitrarily established as one-half as great as the corresponding effect in the entire province.

Costs of Big Game Hunting Activity

Primary costs--The primary costs of game management are those of governmental administration. Overall costs may be determined from administrative accounts. However, because of joint costs, both inter-departmental and intra-departmental, specific allocation of administrative costs to regions

¹ A simplified explanation of Input-Output Analysis is contained in: R.W. Wright, "The Alberta Economy--An Input-Output Analysis," Department of Economics, University of Calgary, 1964, (mimeographed).

seasons, or species is rarely possible. Therefore, these costs must be estimated. While administrative costs are initially borne by the general taxpayer, hunters subsequently reimburse the treasury through license sales and thereby bear part or all of the cost.

Secondary costs--The secondary costs of big game hunting activity are those incurred by businesses to support the sale of goods and services to non-resident hunters. On the assumption that no expansion of existing facilities or hiring of additional labor is necessitated by such sales, only variable costs, comprised of expenditures on the following items, are included:

1. inputs purchased from other firms within the region
2. imported inputs
3. imported finished goods sold directly to the hunters

Fixed costs--depreciation, taxes, insurance, interest, rent, and labor--would remain largely unchanged without the non-resident hunting activity; therefore they are excluded in determining the costs of supporting the sale of goods and services to non-resident hunters.

Summary

The benefits and costs associated with big game hunting activity are summarized in Table I. To facilitate evaluation from different viewpoints, a distinction is

drawn between resident and non-resident hunters. If the evaluation is from the viewpoint of society in general, all hunters are residents and net social benefits are approximated by license fees paid plus extra-market benefits received by all hunters, minus the administrative costs of game management.

The benefits and costs associated with non-resident hunting are relevant only to regional evaluations. The value of net regional primary benefits is approximated by license fees paid plus extra-market benefits received by all resident hunters, minus administrative costs of game management.

The value of net secondary benefits is the total impact upon the regional economy of non-resident hunter expenditures, minus the cost to the regional economy of providing the goods and services on which the expenditures are made.

In this study two regional evaluations are conducted. In the case of the province of Alberta, non-resident hunters consist of those from outside the province while from the viewpoint of Northern Alberta hunters from outside Alberta as well as Alberta residents who reside outside the northern region are included in the non-resident category. Upon this conceptual basis, the need for specific data to meet the objectives of the study is apparent.

Table 1

SUMMARY OF BENEFITS AND COSTS OF RESIDENT AND
NON-RESIDENT BIG GAME HUNTING ACTIVITY.

Type of Hunter	Benefits	Costs
Resident	1. Primary benefits received by all hunters and consisting of license fees plus extra-market benefits.	1. Primary costs of game management, initially borne by the general taxpayer who is subsequently reimbursed by hunters through license sales.
Non-resident	1. Primary benefits to the regional treasury through sale of hunting licenses to non-resident hunters.	1. Primary costs of game management, initially borne by regional taxpayers who are subsequently reimbursed through license sales to non-resident hunters.
	2. Secondary benefits to the local economy resulting from expenditures in the region by non-resident hunters.	2. Secondary costs incurred by regional businesses to support the sale of goods and services to non-resident hunters.

CHAPTER III

DATA COLLECTION AND PRESENTATION

For the analysis undertaken in this study, information is required concerning primary and secondary benefits and costs of moose hunting activity in Zone 1. The Fish and Wildlife Division of the Alberta Department of Lands and Forests provided the data on primary costs of game management and administration.

Costs of Game Management

With the exception of that relating to National Parks, game management in Canada is the responsibility of the Provincial governments. In Alberta it is under the jurisdiction of the Fish and Wildlife Division of the Department of Lands and Forests.

For the five fiscal years up to and including that ended March 31, 1968, total revenue of the Fish and Wildlife Division averaged \$1,122,988.87 per year and was obtained primarily from hunting, angling, commercial fishing, and fur dealers licenses, fur taxes, trapline registrations, and

commercial fishing royalties.¹ Revenue from the sale of hunting licenses alone (including Wildlife Certificates) averaged \$931,452.60 for the same period or approximately 83 percent of the total revenue.

Average annual Divisional expenditures for this five-year period exceeded revenue by \$63,071.40 or 5.62 percent. For the fiscal year ended March 31, 1969, total expenditures were distributed approximately as follows:

Fisheries	\$ 158,000.
Wildlife	\$ 146,000.
Enforcement	\$ 229,000.
General Administration	\$ 99,000.
Mobile Equipment	\$ 55,000.
Salaries	\$ 1,000,000.

The latter three categories of expenditures come under the general heading of Administration and are spread over the Fisheries, Wildlife, and Enforcement Sections. If total administration costs are allocated in proportion to the initial budget for these three sections, the distribution of total divisional expenditures becomes:

¹ The information on revenue and expenditures of the Fish and Wildlife Division is obtained from the Annual Reports of the Department of Lands and Forests and by personal interview with Mr. C. G. Campbell, Administrator, Fish and Wildlife Division.

Fisheries	\$ 500,086.
Wildlife	\$ 462,105.
Enforcement	\$ 724,809.

The budget for enforcement is also divided between the Fisheries and Wildlife sections. Specific allocation is made on the basis of the frequency in these sections of violations resulting in convictions. For the five fiscal years up to and including that ended March 31, 1968, 76.8 percent of all such convictions were for hunting violations and 23.2 percent for fisheries violations.¹ Seventy-five percent of the budget for enforcement therefore is allocated to wildlife and 25 percent to fisheries, resulting in the following estimates of the total cost of Alberta fisheries and wildlife management, respectively:

Fisheries	\$ 681,288.25
Wildlife	\$ 1,005,712.00

As shown above, salaries comprised approximately 59 percent of the total Division budget. Therefore, the regional distribution of personnel is taken as an indicator of the regional allocation of total spending. The portion of the total cost of wildlife management that should be

¹ Alberta Department of Lands and Forests, Annual Reports (Edmonton: Alberta Department of Lands and Forests, 1964-1968).

allocated to Big Game Zone 1 is arrived at by estimating the portion of total regional office (Head Office personnel are not included in this calculation) personnel whose main areas of responsibility lie within Big Game Zone 1.¹ This portion is estimated to be 38 percent of the officers, 31 percent of the biologists, and 33 percent of all other personnel. If a weighted average of 35 percent is used, then the total cost of wildlife management in Zone 1 for the fiscal year ended March 31, 1969, is estimated at \$351,999.20 ($.35 \times \$1,005,712.00$)

Further allocation of total expenditures to individual species is not attempted. Deer, bear, and birds are hunted in nearly all accessible areas of Zone 1. Caribou are hunted in some areas as well as elk, sheep, and goats in the southwest portion of the zone. However, moose are by far the predominant hunted species in the entire zone. The total cost to the Fish and Wildlife Division of moose management in Big Game Zone 1 for the fiscal year ended March 31, 1969, is therefore estimated at \$350,000.00. This cost initially was borne by the Alberta taxpayer. However, the Provincial Treasury was reimbursed a total of \$349,436.00 through sales

¹ Estimates are made from regional Fish and Wildlife Division personnel listings for that year. In border cases, for example Edson and Lac La Biche, only a portion of the district personnel were assigned to Zone 1.

of hunting licenses to Zone 1 moose hunters. Therefore, the moose hunting segment of society was not subsidized to any extent by the general taxpayer.

The imprecise nature of the final estimate of total costs is recognized, but every attempt is made to achieve as realistic an estimate as available information permits. Nevertheless, because of the difficulty of allocating expenditures to individual species the figure is probably high.

The figure of \$350,000 is an estimate of the 1968 primary costs of moose hunting activity in Zone 1. To obtain estimate of secondary costs and primary and secondary benefits, specific information from the hunters is required.

Hunter Data Requirements

The hunter information required (Chapter II) to meet the objectives of this study (Chapter I) is translated into specific data requirements. These requirements are listed and defined in six categories, as follows:

1. Number of hunters by license category and their place of residence: Three residential and economic regions are defined--Northern Alberta (north of Highway 16 and excluding Edmonton), Southern Alberta (south of Highway 16 but including Edmonton,) and outside Alberta.

2. Number of moose killed.
3. Number of days spent hunting.
4. Total season hunter expenditures by economic region.
5. Hunter expenditures directly associated with hunting:

An attempt is made to estimate the portion of total expenditures (obtained for number four, above) that may be directly attributed to the hunting experience.

The following expenses are included: equipment rental fees, expenditures for commercial lodging, two-thirds of restaurant meals, transportation costs, guide fees, one-half of miscellaneous expenses, and license fees.

In the case of non-residents, where an individual visited Alberta for reasons in addition to hunting, certain of the above categories were allocated to activities in proportion to time spent in those activities. Specifically expenditures on lodging, restaurant meals, transportation and

¹ Expenditures on hunting and camping equipment, arms and ammunition, clothing, cameras and film are excluded, as the portion of their cost that may be allocated to this one season or trip is probably very small. Any estimate would be difficult and arbitrary. One third of the cost of restaurant meals, spending on alcoholic beverages and one half of miscellaneous expenses are also excluded on the assumption that these items would have been consumed even if the hunt had not taken place. However, all of the expenditures are included when evaluating economic impact.

miscellaneous items were multiplied by the factor.¹

$$\frac{\text{no. of days hunted}}{\text{no. of days away from home less two days}}$$

6. Extra-market benefits received by the hunters: Each hunter was asked if he considered the total value he received from his experience to be greater than the incurred costs and if so, how much, as a percentage of the costs. This percentage, applied to his incurred costs defined under five above, yields an approximation of the extra-market benefits the hunter received per hunting day.²

Hunter Data Sources

Hunter Interviews

To obtain the required hunter data, as well as to gain insight into questionnaire design for the mail survey, in-field interviews with non-resident hunters were conducted during the hunting season. As compulsory check-points were not maintained, the sample interviewed was heavily weighted

¹ This factor shows the proportion of recreation days (with two days subtracted for travel) that was spent hunting.

² By definition, any quantitation of extra-market benefits is only an estimate. The estimate obtained by the method described here is thought to be conservative as some hunters may have made their estimate as a percentage of total "out-of-pocket" expenditures, rather than of only those expenditures that are directly attributable to the hunting experience itself.

in favor of successful hunters. (Many interviews were conducted when successful parties appeared at district Fish and Wildlife Offices to obtain export permits.) Moreover, due to the length of the season and large size of Zone 1, the sample was neither temporally nor spatially well distributed. To obtain information from resident hunters and from a more random sample of non-residents than the interviews provided, a mailout survey of a random sample of all hunters was conducted at the end of the hunting season. Experience gained in hunter interviews provided valuable assistance in designing a mailout questionnaire that would minimize response bias.

Mail Survey

Before hunting in Alberta in 1968, all hunters were required to purchase a Wildlife Certificate. The certificate cost \$2.00 and entitled the holder to subsequently purchase various licenses to take specific animals or birds. There were approximately 300 license vendors in the province who, prior to the hunting season, were provided with a quantity of certificates and licenses for sale to hunters. These were numbered and distributed in blocks of numbers in ascending numerical order and alphabetically according to the first letter of the vendor's last name. When a vendor's initial supply of licenses or certificates was exhausted, he ordered more. Additional supplies were provided in ascending

numerical order as requests were received. The Wildlife Certificate shows the name and address of the licensee. The license contains only the Wildlife Certificate number of the licensee plus the number of his corresponding game tag. Counterfoils of all certificate and license sales are kept in the Fish and Wildlife Division headquarters.

A total of 4,343 non-resident and non-resident alien special moose licenses were sold, entitling the purchaser to hunt and kill, when in the company of a licensed guide, one moose of either sex anywhere in Zone 1 on any day except Sundays between September 2 and December 21, 1968. A 10 percent sample of this group of hunters was desired. To obtain a random sample, the counterfoils of issued licenses were used. A starting point between the numbers one and ten was randomly chosen and the corresponding license plus every tenth one subsequent to it were drawn. Thus each license had an equal chance of being chosen. There was no evidence of non-random ordering with respect to the variables of hunter characteristics required for this study. That is, no grouping or trend effects could be observed in values of these variables. The wildlife Certificate numbers of the licensees were recorded from the sample of licenses and their names and addresses obtained from counterfoils of issued Wildlife Certificates. A sample of 415 hunters, whose names and

addresses were legibly and apparently completely recorded, was obtained.¹ A questionnaire and covering letter was sent to each of these individuals.² Twenty-four envelopes were returned unopened, leaving an effective mailout of 391 questionnaires. The number responding to the first mailing was 213, of which 210 provided information sufficiently complete for analysis. An additional forty-six (all providing adequate information) responded to a reminder letter sent approximately one month after the first mailing, giving a total response of 66.2 percent.

From the records of moose export permits issued, an estimate of actual non-resident hunter success was obtained.³ Comparison of this figure with success indicated by the questionnaire enabled an estimate of success of non-respondents.

¹ Names and addresses of hunters are handwritten on the Wildlife Certificate by the vendors. A considerable number were illegible or incomplete with the result that some letters were not sent and others were returned unopened. Such omissions are assumed random.

² Copies of the questionnaire, covering letter and reminder letter, sent to both resident and non-resident hunters, are contained in the appendix.

³ In certain areas (for example, Hinton), export permits for moose killed on the Special license could not be differentiated from those for moose killed on the Alien Big Game license. For those areas non-resident harvest of moose on the latter license is assumed equal to the number of elk killed on the same license.

Approximately 1,792 moose were exported from Alberta by holders of non-resident special moose licenses, indicating an actual success rate of 41.3 percent. For the 391 non-resident hunters who received a questionnaire, the expected kill is 161 moose ($391 \times .413$). However, the 256 persons responding to the questionnaire reported killing 131 moose (51.2 percent). The remaining 135 non-respondents could therefore only account for 30 moose, for a success rate of 22.2 percent. Successful hunters were therefore approximately 1.5 times more responsive than unsuccessful hunters (81.4 percent versus 54.3 percent). In obtaining sample statistics, the unsuccessful group of sample respondents is therefore given 1.5 times more weight than the successful group.

In 1968, resident wildlife certificate holders could purchase either one or both of two types of moose licenses: 1. resident moose license, usable in any open area of the province during specified seasons and 2. resident Zone 1 moose license, usable only in Big Game Zone 1. A total of 39,943 of the former and 3,692 of the latter were sold. Randomly cited systematic samples were drawn from counterfoils

¹ A similar analysis of 1967 non-resident special moose hunters revealed that successful hunters in that year were 1.8 times as responsive as unsuccessful (64.4 percent versus 35.9 percent).

of both classes of issued licenses by the same method as described for non-resident hunters, with the exception that samples of one-eleventh rather than one-tenth were taken.

A total of 3,813 questionnaires were mailed and 3,629 actually received by the hunters.¹ Response to the first mailing was 1,351 returned questionnaires and to the reminder letter an additional 539, to give a final response of 52.1 percent.

Sales records readily reveal how many hunters purchased each of the two types of licenses but not how many individuals purchased both types. Consequently, a precise figure for total moose hunters is not known. The task of determining this figure from sales records is too time consuming and expensive for the scope of this study. An estimate has been derived using the composition of the return sample. This estimation is somewhat complicated for three reasons. First, hunters possessing both licenses were sampled twice as heavily as those possessing only one. In addition, the names of some individuals in this category would be drawn twice, in which case only one questionnaire was sent.

¹ The difficulty of illegible and/or incomplete names or addresses was encountered with resident hunters as with non-residents.

Second, holders of the different licenses were not equally successful in their hunting.¹ In particular, those hunters possessing both licenses were more successful than those possessing only one. A reasonable explanation may be that some hunters did not purchase a second license until their first one was filled. The complication arises from the fact that success appears to influence hunter response to mail-out questionnaires.² If successful hunters are more responsive than unsuccessful, then sample returns will be biased in favor of those license categories in which success is highest.

The third reason for difficulty in estimating resident hunter populations arises from a mishap that occurred during the coding process. A number of questionnaires received in response to the first mailing from resident hunters who indicated they did hunt in Zone 1, were lost. The loss

¹ The term, "success, " is used throughout the study in the limited sense of having killed a moose. In fact some hunters who did not kill a moose may have had a more "successful" season in terms of want-satisfaction than others who did.

² Alberta's experience with non-resident special Zone 1 moose hunters in both 1967 and 1968 (Supra, page 44) support this conclusion. See D. MacDonald and E.G. Dillman, "Techniques for Estimating Non-statistical Bias in Big Game Harvest Surveys," Journal of Wildlife Management, XXXII (1968), 119-129.

is not as serious as it may first appear. At this stage no ordering had been done so the loss may be reasonably assumed random.

Essentially the task of estimating resident hunter population is one of adjusting the return sample to one that is proportionately equal in composition to the hunter population and from the adjusted sample estimating the number of hunters who possessed both the resident and special Zone 1 license. The adjusted sample compensates for double sampling and duplication in this category of hunters and for the influence of success on response in all license categories. Compensation for success was achieved through weighting the sample of unsuccessful hunters one and one-half times greater than that of successful hunters in all categories, as explained on page 44.

Table 2 presents the composition of the sample used for analysis and of the hunter population. This table applies only to Zone 1 hunting. In addition, an estimated 18,915 residents hunted moose in other areas of the province in the same year. Also 59 Canadians residing outside Alberta and 644 non-Canadians purchased Alberta Big Game Licenses during 1968. These licenses entitled the holder to hunt and kill, when accompanied by a qualified guide in any open area of the province, one trophy sheep, one mountain

goat, one antlered animal (including moose, elk or deer, and one black or brown bear.

A total of 40,385 Alberta residents hunted moose in Alberta during the 1968 hunting season. Approximately 30 percent (11,947) of the total resident moose hunters lived north of Edmonton while 70 percent (28,438) lived in or south of Edmonton.¹ Alternatively, approximately 53 percent (21,470) of all resident moose hunters hunted in Zone 1 while the major moose hunting activity of the remaining 47 percent (18,915) occurred in other big game zones of the province. A total of 25,813 moose hunters, including the 4,343 non-residents, were accommodated in Zone 1 during the 1968 season.

The total 1968 moose harvest in Zone 1 is estimated at 8,657 animals.² Non-resident hunters had the highest success rate (41.3 percent), followed by local hunters with 37.7 percent. Non-local hunters were least successful (22.0 percent).

¹ People residing north of Edmonton are referred to in this study as "local residents ", while residents of Edmonton or south of Edmonton are referred to as "non-local residents".

² A chronology and classification of total moose kill is contained in the appendix.

Table 2

COMPOSITION OF SAMPLE, ESTIMATED MOOSE HUNTER POPULATION AND MOOSE HARVEST,
BY HUNTER ORIGIN AND LICENSE CATEGORY: 1968 SEASON, ALBERTA ZONE 1.

Origin of Hunters	License Category	Sample for Analysis		Hunter Population		Success Rate (percent)	Moose Harvest*
		Succ.	Unsucc.	Total	Succ.	Unsucc.	Total
Local Resident	Resident	114	157	271	3226	6635	9861
	Special	6	7	13	88	141	229
	Resident Plus Special	86	31	117	1194	663	1857
	All Local Resident Hunters-----				4508	7439	11947
Non-Local Resident	Resident	56	150	206	1576	6342	7918
	Special	4	8	12	53	159	212
	Resident Plus Special	33	45	78	464	929	1393
	All Non-Local Resident Hunters -----				2093	7430	9523
Total, All Resident Hunters -----					6601	14869	21470
Non-Resident		131	125	256	1792	2551	4343
Grand Total, All Hunters-----					8393	17420	25813

8657

* Total moose harvest estimates exceed estimates of total successful hunters, as some of the residents who possessed the two types of license killed two moose.

Hunter Data Reliability

Two major kinds of bias traditionally plaguing sample surveys of the mail-out type are described by MacDonald and Dillman.¹ The first kind is response bias introduced by respondents who incorrectly report details of their activity. The second kind of bias described is non-response bias arising from differences in activity, performance, or characteristics between those who respond to mail-out questionnaires and those who do not. Response bias is difficult to identify and to correct. Questionnaire design is crucial. If reasonable and objective answers are to be obtained, individuals receiving the questionnaire must have a thorough understanding of the questions asked. For the present study preliminary hunter interviews greatly aided questionnaire design. The question in which hunters are asked to evaluate their extra-market benefits may be thought particularly subject to response bias. Suspicion that increased license fees are pending may cause hunters to underestimate their benefits. On the other hand, the emotional and aesthetic appeal which things of nature hold for many people may result in overestimation. Hopefully if such bias does exist in these two

1

D. MacDonald and E. William, op. cit., pp. 119-129.

directions, one will partially or fully compensate for the other.

The second type of bias, resulting from individuals exhibiting certain characteristics being less responsive to mail-out questionnaires than others, is called non-response bias. In the preceding pages estimates were made of hunter populations and moose harvest. To obtain these estimates, successful and unsuccessful samples were weighted to compensate for non-response bias introduced by the success factor. Such precise identification and measurement of bias is not possible for the other characteristics.

In an attempt to find a means of measuring additional non-response bias, the following hypothesis is advanced. If hunters possessing specific characteristics are differentially responsive to questionnaires, then such characteristics exhibited by respondents to the first mailing will be significantly different from those exhibited by respondents to the second mailing, and non-response bias may be measured through a comparison of first and second mail respondents.

This hypothesis is tested on non-resident hunters through a Chi-square analysis of first and second mail respondents on the known characteristic of hunter success. Contingency tables of observed and expected frequencies of successful versus unsuccessful hunters for the two mailings

are constructed as shown in Table 3. The expected frequencies are computed so that all of the totals are the same as in the actual observation and cell frequencies are proportional to the totals. A chi-square value of 0.43 is found by the formula,

$$\text{Chi-square} = \sum \left(\frac{f_o - f_e}{f_e} \right)^2$$

where f_o = observed frequency and f_e = expected frequency.

Comparison of the Chi-square value with the value of 3.84, obtained from Chi-square distribution tables for the five percent level of significance and one degree of freedom, indicates that the hypothesis that hunters responding to first and second mailings are differentially successful cannot be accepted. Although the successful hunters are known to have responded better to the questionnaire than did unsuccessful, this fact is not revealed in their response to first and subsequent mailings or reminders. Therefore, a comparison of first and second mail respondents cannot be confidently used to identify and measure non-response bias. Therefore, for this study the only non-response bias identified is that resulting from hunter success. Compensation is made through weighting the sample observations of all variables in favor of unsuccessful respondents. The precise weighting procedure is discussed on page 44.

Table 3

FREQUENCY TABLES, INFLUENCE OF HUNTER SUCCESS

ON RESPONSE TO FIRST AND SECOND MAILINGS:

NON-RESIDENT MOOSE HUNTERS, 1968

Mailing	<u>Observed</u>		Total		<u>Expected</u>		Total
	Successful Yes	No			Mailing	Success Yes No	
First	105	105	210		First	107 103	210
Second	26	20	46		Second	24 22	46
Total	131	125	256		Total	131 125	256

Summary of Hunter Data

Observations of the following specific hunter characteristics are required: days hunted, daily costs associated with hunting, daily extramarket benefits received, and total season regional expenditures. Statistics for these variables are presented in Table 4.

Non-residents hunted an average of 4.84 days, incurring directly associated costs of \$48.64 per day and receiving extramarket benefits of \$11.99 per day. In addition to the \$52.00 License fee paid to the Alberta Government, non-residents spent an average of \$188.51 in Northern Alberta, \$50.03 in Southern Alberta, and \$55.98 outside the province-- a total

Table 4

ESTIMATES OF POPULATION MEANS AND VARIANCES BY HUNTER CLASS, OF DAYS HUNTED, ASSOCIATED COSTS, EXTRAMARKET BENEFITS, AND TOTAL REGIONAL EXPENDITURES: 1968 ZONE 1 MOOSE HUNTERS

Hunter Category	Hunted			Daily Costs			Daily Extra-market Ben. Appropriated			Total Season Expenditures		
	mean	var.	mean	var.	mean	var.	mean	var.	mean	var.	mean	var.
Non-resident ^a	4.84	2.81	48.64	415.43	11.99	297.46	188.51	8200.42	50.03	2105.42		
Non-local resident,												
Resident license	4.53	7.96	14.04	83.55	5.48	48.55	62.99	3824.61	81.11	9274.70		
Special license	3.25	2.32	15.42	42.90	3.72	8.47	55.10	1188.75	97.75	9589.08		
Both licenses	6.01	11.08	13.92	50.46	5.67	33.66	88.99	6636.12	126.74	20202.80		
All Non-locals	4.72	5.74	14.05	58.86	5.47	34.29	66.62	2786.51	88.16	6848.30		
Local resident,												
Resident license	6.56	21.01	7.10	35.88	2.98	11.72	108.20	12435.51	.61	30.02		
Special license	9.95	29.69	4.65	7.15	1.15	2.11	89.27	1969.07	--	--		
Both licenses	7.98	27.21	7.37	43.91	3.76	16.34	150.51	18312.78	2.00	52.71		
All locals	6.84	14.97	7.09	25.55	3.07	8.38	114.39	8997.70	.81	21.72		
All Residents	5.90	5.76	10.18	19.49	4.13	9.34	93.20	3302.83	39.55	1353.79		
All Hunters	5.72	4.09	16.65	25.20	5.45	14.85	109.22	2515.82	41.31	995.79		

^a Non-residents also spent an average of \$55.98 outside Alberta.

of \$346.52 for their hunting experience.

Non-local residents hunted an average of 4.72 days, while the average length of time spent hunting by local residents was 6.84 days. Average daily costs directly associated with hunting and daily extra-market benefits received were \$14.05 and \$5.47, respectively, for non-local resident hunters and \$7.09 and \$3.07 respectively, for local resident hunters. The weighted average license fee¹ for non-local resident hunters was \$5.73 and for local residents, \$5.78. In addition to the license fee the average non-local resident hunter spent \$66.62 in Northern Alberta and \$88.16 in Southern Alberta for a seasonal total of \$160.51. Total season expenditures, excluding license fees, of local resident hunters averaged \$115.20, almost all of which was spent in Northern Alberta.

The data required for economic evaluations of current moose hunting activity have been presented. In Chapter IV these data are utilized in the actual evaluation procedure within the conceptual framework developed in Chapter II.

¹ The fee for each resident license is \$5.00. Those hunters who purchased both licenses therefore paid a \$10.00 fee.

CHAPTER IV

EVALUATION OF ZONE I MOOSE RESOURCES

The net benefits of Zone 1 moose hunting activity vary with the viewpoint from which evaluation is made, i.e. from that of Northern Alberta, the entire province, or society in general. This chapter contains an evaluation of gross benefits and costs from each of these viewpoints in turn. A summary of net benefits by region is presented at the conclusion.

Society in General

Gross Benefits

From the viewpoint of society only primary benefits may be considered in evaluating recreational resources. To the extent that secondary benefits of economic activity generated by recreation and appropriated by specific sectors or regions within society are offset by an equivalent decrease in economic activity in other sectors or regions, society experiences a transfer of benefits but little or no aggregate increase or decrease.

This study measures only those primary benefits of big game resources realized by hunters. Important primary

benefits of wild animals also accrue to non-hunters. They are a particular source of enjoyment, for example, for tourists and photographers, both amateur and professional. In addition, some people, never themselves in a position to view wildlife in its natural environment, reap benefits from the knowledge that the opportunity to do is available and from the assurance that this opportunity will continue to be available to future generations. These benefits are recognized and emphasized as important considerations in policy decisions affecting wildlife. In this study, however, their quantification is not attempted.

The gross benefits received by moose hunters from their 1968 experience in Alberta Zone 1 are presented in Table 5. Only a portion of these benefits may be considered in evaluating the moose resources. This portion consists of the license fees paid by the hunter plus any extra-market benefits he receives from his hunting experience. The remaining portion of the benefits of the total experience is a measure of the value of such items as guiding services, lodging, and so on.¹ The gross benefits realized by the

¹ As explained in Chapter II, the hunter purchases a composite bundle of goods and services, only one component of which is the wildlife resource. Assuming all components except the wildlife resource are purchased in a competitive market, the hunter pays for their full value. From these components he receives no benefits in excess of his costs....

Table 5

VALUE TO ZONE 1 MOOSE HUNTERS OF THEIR TOTAL HUNTING
EXPERIENCE^a AND OF THE MOOSE RESOURCES^b, 1968 SEASON

License Category	Number of Hunters	Value of the Total Hunting Experience		Value of the Moose Resource	
		Per Hunter	Total	Per Hunter	Total
Non-resident	4,343	293.45	1,274,453.35	110.03	477,860.29
Non-local Resident,					
Resident license	7,918	88.43	700,188.74	29.82	236,114.76
Special license	212	62.21	13,188.52	17.09	3,623.08
Both licenses	1,393	117.74	164,011.88	44.08	61,403.44
All non-locals	9,523	92.13	877,389.08	31.62	301,141.28
Local Resident,					
Resident license	9,861	66.12	652,009.32	24.55	242,087.55
Special license	229	57.71	13,215.59	16.44	3,764.76
Both licenses	1,857	88.82	164,938.74	40.00	74,280.00
All locals	11,947	69.49	830,163.65	26.80	320,132.31
Total, all residents	21,470	79.53	1,707,552.73	28.94	621,273.59
Total, all hunters	25,813	115.52	2,982,006.08	42.58	1,099,133.88

^a The value to the hunter of his total experience is approximated by his incurred costs plus his extramarket benefits.

^b The value to the hunter of the moose resource is approximated by the price of the hunting license plus his extramarket benefits.

hunting segment of society from the moose resources of Zone 1 during the 1968 hunting season amounted to a total of \$1,099,133.88 or an average of \$42.58 per hunter. The market component of this total comprises license fees of \$349,436.00 (\$13.54 per hunter) and the extra-market component, \$749,697.88 or \$29.04 per hunter.

Costs

The only costs to society in general of supporting Zone 1 moose hunting activity are the primary costs of game Management. These are borne by the Alberta Provincial Treasury and are estimated for the 1968 season at \$350,000.¹

Net Benefits

The net social benefits derived from Alberta Zone 1 moose resources during the 1968 hunting season may be summarized as follows:

Market benefits (license fees)	\$ 349,436.00
Extra-Market benefits	\$ 749,697.88
Total primary benefits	\$1,099,133.88
Administration Costs	\$ 350,000.00
Net social primary benefits	\$ 749,133.88

....For the wildlife resource, however, he pays a standard license fee which may or may not reflect the value of the resource. From wildlife the hunter may therefore receive value in excess of his costs. This extra-market value, if any, must be included in an evaluation of the wildlife resource.

¹ Supra. Page 35.

All net benefits were directly received by the moose hunters. The costs of administration were initially borne by Alberta taxpayers. However, through license purchases the hunters subsequently reimbursed the general taxpayers for essentially all administrative costs.

The Province of Alberta

Gross Benefits

In addition to primary benefits received by Alberta residents, the province receives both primary and secondary benefits from non-resident hunting activity. As discussed in Chapter II, secondary benefits of recreational activity may be realized by certain regions or sectors of the total economy. Business activity, generated by non-residents of a region engaged in recreation within the region, constitutes a partial transfer of benefits into that region from without. Similarly any direct tolls levied non-residents represent primary benefits to the region.

Gross primary benefits to the province of Zone 1 moose resources are approximated by the value of the moose resources to all resident hunters, plus the license fees collected from non-resident hunters. The total value of the moose resources to Alberta residents is \$621,273.59 or \$28.94 per resident hunter (Table 5), comprised of a market

component of \$123,600.00 (\$5.76 per hunter) paid in license fees, plus an extra-market component of \$497,673.59 or \$23.18 per hunter. License fees collected from non-resident hunters amounted to \$225,836.00, to give total primary benefits of \$847,109.59.

Secondary benefits to the province of Zone 1 moose hunting activity are estimated through the technique of input-output analysis. Using 1962 tables, the impact of non-resident hunter expenditures on the Alberta economy is estimated.¹

Hunter expenditures represent increases in final demand for the products of provincial industries. All of the industries affected come under the heading of "service industries." The column totals of the Inverse Leontief matrix indicate the total expansion in sales throughout the economy of Alberta resulting from a one dollar increase in final demand for the products of that industry. Therefore, these column totals may be called "impact multipliers" of final demand increases for the respective industries. The multiplier for services industries is 1.173370.² The total spending of non-resident moose hunters in Alberta in 1968 was \$1,036,239.80, distributed as shown in Table 6. The full

¹ R.W. Wright, op. cit.

² Ibid., p. 41.

Table 6

EXPENDITURES IN ALBERTA OF NON-RESIDENT ZONE 1

MOOSE HUNTERS: 1968 SEASON

Expenditure Category	Spending ^a per Hunter (\$)	Spending all Hunters (\$)	Percent of total Expenditures
Equipment rental	5.49	23,843.07	2.30
Overnight lodging	12.72	55,242.96	5.33
Restaurant meals	19.52	84,775.36	8.18
Food other than restaurant	18.49	80,302.07	7.75
Alcoholic beverages	8.45	36,698.35	3.54
Gasoline and motor	41.09	178,453.87	17.22
Transportation fares	2.13	9,250.59	0.89
Guiding services	101.39	440,336.77	42.50
Clothing	5.39	23,408.77	2.26
Hunting & camping equip.	3.14	13,637.02	1.32
Arms and ammunition	1.07	4,647.45	0.45
Cameras and film	2.15	9,337.45	0.90
Miscellaneous	17.57	76,306.51	7.36
Total spending	238.60	1,036,239.80	100.00

Impact multiplier - 1.173370

Total impact of all spending - \$1,215,892.69

^a The average spending of the non-resident sample is obtained by weighting the unsuccessful respondents 1.5 times heavier than the successful respondents.

impact or the resulting expansion in Alberta industrial output was \$1,215,892.69. This figure represents gross secondary benefits to Alberta from non-resident hunting of Zone 1 moose during 1968.

Gross benefits to Alberta may be summarized as follows:

Primary benefits appropriated by resident hunters	\$621,273.59
Primary benefits from the sale of non-resident licenses	225,836.00
Secondary benefits from the sale of goods and services to non-residents	1,215,892.69
GROSS BENEFITS	\$2,063,002.28

Costs

The primary costs of wildlife management in Alberta are borne by the provincial treasury. The total cost of the management of moose in Zone 1 for the fiscal year ended March 31, 1969, are estimated at \$350,000.00.

In addition to the direct costs of game management, secondary costs are incurred by sellers of goods and services to non-resident hunters. From the matrix of transactions of the Alberta economy,¹ the cost of inputs as a percentage of total production in Alberta industries can be ascertained. The inputs for which extra expenditures are incurred as a result of sales to non-resident hunters are domestically produced inputs and imported inputs. The percentage of total

¹ Ibid., page 37.

use that is spent on these inputs in each industrial group is multiplied by the coefficient of the respective industry in the service industries column of the inverse matrix. The result provides an indication of the total direct and indirect expansion in the respective expenditures of that industry, resulting from a one dollar increase in final demand for the products of the Service Industries. The total for all industries gives the aggregate increase in expenditures throughout the economy. Every dollar increase in final demand for the products of the service industries results in a total direct and indirect increase, in the purchase of domestically produced inputs throughout the economy, of 18,2332 cents, and of imported inputs of 6.4517 cents. The increase in requirements for both classes of inputs is 24.6849 cents. In other words, the variable cost to the Alberta economy of supporting a dollar of sales of goods and services to non-resident hunters is approximately twenty-five cents.

Non-resident hunter spending in Alberta during the season totalled \$1,036,239.80 and induced a total increase in sales of Alberta industries of \$1,215,892.69 (Table 6). The cost to the Alberta economy of supporting these sales, as explained above, was $\$1,036,239.80 \times .246849 = \$255,794.76$.

Net Benefits

The province of Alberta realized an estimated \$1,457,208

in total benefits from Zone 1 moose resources during the 1968 season (Table 7). Net primary benefits of \$497,110 were almost all received by resident moose hunters in the form of extra-market benefits.¹ The business sector of the economy received approximately \$960,098 in net secondary benefits.

Northern Alberta

Gross Benefits

The economy of Northern Alberta gains directly from regional hunting activity in the form of primary benefits to local hunters. It also receives secondary benefits from the regional spending of non-resident hunters, both non-local Alberta residents and out-of-province people.

The value of Zone 1 moose resources to local hunters amounted to a total of \$320,132.31 (Table 5). This value is composed of license fees (\$69,020.00) plus extra-market benefits (\$251,112.31) and is a measure of the gross primary benefits received by Northern Alberta from Zone 1 moose resources during 1968.

Currently available data does not enable as rigorous establishment of the full impact of non-resident spending on the economy of Northern Alberta as on that of Alberta as a

¹ Estimated costs of game management exceeded revenue from license sales by \$564.00. The small loss is deemed insignificant.

Table 7

SOCIAL BENEFITS AND COSTS TO ALBERTA OF ZONE 1
MOOSE HUNTING ACTIVITY, 1968

License fees collected from resident hunters	\$ 123,600
Extra-market benefits to resident hunters	\$ 497,674
License fees collected from non-resident hunters	\$ 225,836
Gross Primary Benefits	\$ 847,110
Costs of game management	\$ 350,000
Net Primary Benefits	\$ 497,110
Secondary benefits resulting from non-resident hunter spending in Alberta	\$ 1,215,893
Secondary costs of supporting sales to non- resident hunters	\$ 255,795
Net Secondary Benefits	\$ 960,098
TOTAL NET SOCIAL BENEFITS	\$ 1,457,208

whole. Without an input-output table for Northern Alberta, the induced regional effects of first-round expenditures cannot be determined. Neither the construction of an input-output table nor the adaption of the provincial table are feasible within the scope of the present study. While the inter-industry transactions may not be greatly different, leakages due to imports will probably be significantly greater from the northern region than from the whole province. In this study the impact multiplier for Northern Alberta is arbitrarily

established at 1.086685.¹ By using the lower multiplier, compensation is made for the suspected greater leakage from the Northern Alberta economy due to relatively larger imports of finished products into the northern region.

The impact of expenditures in Northern Alberta of hunters from outside the region is summarized in Table 8. Out-of-province hunters spent almost three times as much money per hunter in Northern Alberta as did non-local residents. The reason is largely explained by the compulsory guiding legislation for non-residents. Their expenditures in Northern Alberta apart from guiding were \$92.72, compared with \$66.62 per non-local resident hunter. Total spending in the region of out-of-province hunters and Southern Alberta hunters amounted to \$818,698.93 and \$634,422.26, respectively. Estimated gross secondary benefits resulting from these expenditures were \$889,667.85 and \$689,417.45 respectively. Gross benefits to Northern Alberta may be summarized as follows:

Primary benefits to local hunters	\$320,132.31
Secondary benefits from visiting hunter spending	\$1,579,085.00
GROSS BENEFITS	\$1,899,217.31

¹ The multiplier for the province is 1.173370. The multiplier for Northern Alberta is $(1.00000 + 1.17337)/2$ or 1.086685.

Table 8

EXPENDITURES IN NORTHERN ALBERTA OF NON-LOCAL ALBERTA RESIDENT AND
NON-RESIDENT ZONE 1 MOOSE HUNTERS: 1968 SEASON

Expenditure Category	Non-local Alberta Residents		Non-residents of Alberta	
	Spending per Hunter (1968 dollars)	Spending All Hunters (1968 dollars)	Spending per Hunter (1968 dollars)	Spending All Hunters (1968 dollars)
Equipment rentals	2.37	22,569.51	4.71	20,455.53
Overnight lodging	5.41	51,519.43	7.75	33,658.25
Restaurant meals	8.89	84,659.47	11.48	49,857.64
Food other than restaurant	7.66	72,946.18	13.94	60,541.42
Alcoholic beverages	3.40	32,378.20	6.06	26,318.58
Gasoline and motor	24.01	228,674.23	24.77	107,576.11
Transportation fares	--	--	1.40	6,080.20
Guiding services	--	--	95.79	416,015.97
Clothing	1.93	18,379.39	4.68	20,325.24
Hunting and camping equipment	2.87	27,331.01	2.83	12,290.69
Arms and ammunition	5.20	49,519.60	.95	4,125.85
Cameras and film	.26	2,475.98	1.73	7,513.39
Miscellaneous	4.62	43,996.26	12.42	53,940.06
Totals	66.62	634,422.26	188.51	818,698.93
Impact multiplier - 1.086685 ^a				
Total Impact of Hunter Spending:	Out-of-province hunters - \$889,667.85			
	Southern Alberta hunters - \$689,417.15			
	Total - \$1,579,085.00			

^a The impact multiplier for the province as a whole is 1.173370 (Table 4. 2).
The impact multiplier for Northern Alberta is $(1.173370 - 1.00000)/2.0 + 1.000000 =$
1.086685. The adjustment is made to reflect a larger proportion of imports into
Northern Alberta than that proportion for the province as a whole.

Costs

The total costs incurred by the Fish and Wildlife Division for Zone 1 moose management in 1968 are estimated at \$350,000.00. Of this total, an estimated 15 percent or \$52,500.00 is borne by the taxpayer of Northern Alberta (assumes the tax burden is proportional to population).

The variable costs to the business sector of Alberta for supplying the goods and services for sale to non-resident hunters is estimated at 24.6849 cents per dollar of sales (Page 64). This cost consists of expenditures for domestically produced inputs and imported inputs. Northern Alberta is probably required to import relatively more productive inputs than is the province. This component of variable costs therefore will be higher for Northern Alberta than for the province. However, the higher cost of imported inputs may be offset by a lower requirement of locally produced inputs, so that the total variable costs for Northern Alberta of goods and services sold to visiting hunters may not be very different than for Alberta as a whole. In this study they are assumed to be 25 cents per dollar of sales. Aggregate secondary costs are as follows:

for out-of-province hunter sales	\$ 204,674.73
for Southern Alberta hunter sales	\$ 158,605.57
Total	\$ 363,280.30

Net Benefits

The total net benefits realized by Northern Alberta from Zone 1 moose hunting activity in 1968 are estimated at \$1,483,437 (Table 9). Net primary benefits amounted to approximately \$267,632 and were largely received by local hunters. To the extent that license fees collected from local hunters exceeded game management costs to Northern Alberta, the local taxpayers also received some primary benefits. Businesses of Northern Alberta received approximately \$1,215,805 in net secondary benefits.

As for society in general and for Alberta, the estimates for Northern Alberta are annual benefits and costs for 1968 only. Should this annual flow of net benefits continue, flows for future years could be discounted and summed to provide a measure of the present value of net benefits received throughout any planning period.

Summary and Implications

The social net benefits of utilizing Zone 1 moose resources to support hunting activity have been evaluated from three viewpoints (Table 10). Net social benefits realized by society during 1968 are estimated at \$29.02 per hunter accommodated. Corresponding figures for the Province of Alberta and for Northern Alberta are \$56.45 and \$57.46, respectively. Alternatively on a per moose killed

Table 9

SOCIAL BENEFITS AND COSTS TO NORTHERN ALBERTA
OF ZONE 1 MOOSE HUNTING ACTIVITY, 1968

License fees collected from local resident hunters	\$ 68,020
Extra-market benefits to local hunters	\$ 251,112
Game management costs borne by taxpayers of Northern Alberta	\$ 52,500
Net Primary Benefits	\$ 267,632
Impact of out-of-province hunter expenditures	\$ 889,668
Impact of Southern Alberta hunter expenditures	\$ 689,417
Cost of supporting sales to out-of-province hunters	\$ 204,675
Net Secondary Benefits	\$1,215,805
TOTAL NET SOCIAL BENEFITS	\$1,483,437

basis, the estimated net benefits in society, to Alberta, and to Northern Alberta are \$86.54, \$168.83, and \$171.36. These results indicate that Zone 1 moose are valuable public resources from both global and regional viewpoints.¹

¹. Social benefits from the moose resources additional to those arising from hunting activity include such benefits as the enjoyment provided tourists and photographers who may not engage in hunting. Some intangible costs may accrue also to those people who object to sport hunting of wildlife. These benefits and costs are recognized but not evaluated in this study.

Table 10

THE BENEFITS AND COSTS TO SOCIETY IN GENERAL, TO ALBERTA, AND TO
NORTHERN ALBERTA OF ZONE 1 MOOSE HUNTING ACTIVITY, 1968

Item	Society in General (1968 dollars)	Province of Alberta (1968 dollars)	Northern Alberta (1968 dollars)
Social Gross Benefits			
Primary	1,099,134	847,109	320,132
Secondary	--	1,215,893	1,579,085
TOTAL	1,099,134	2,063,002	1,899,217
Social Costs			
Primary	350,000	350,000	52,500
Secondary	--	255,795	363,280
TOTAL	350,000	605,795	415,780
Social Net Benefits			
Primary	749,134	497,109	267,632
Secondary	--	960,098	1,215,805
TOTAL	749,134	1,457,207	1,483,437
TOTAL PER MOOSE KILLED	86.54	168.83	171.36
TOTAL PER HUNTER ACCOMMODATED	29.02	56.45	57.46

No estimates of the marginal social benefits and costs of Zone 1 moose hunting activity have been derived. However, the nature of game management costs suggest that moose hunting activity could increase fairly substantially without necessitating a proportional increase in annual primary social costs

(the major management costs are fixed). Further, secondary annual social costs per hunter will not increase provided that expanded hunting activity does not require business establishments to expand existing facilities or hire additional labor in order to serve hunters. Therefore, to the extent that gross benefits are directly a function of the total number of hunters, net social benefits from the moose resources would increase through an expansion in hunting activity.

Constraints such as limited leisure time probably prevent most hunters from increasing their hunting activity to the point of equality of marginal cost and marginal utility. Any expansion in overall hunting activity must result therefore from an increased number of hunters. Restrictions on resident hunter increases are minimal. The number of this category of hunters is expected to undergo a largely normal rate of increase. Specific programs to either promote or restrict the overall number of Zone 1 moose hunters can be affected largely by control over numbers of non-resident hunters.

The extent to which overall moose hunting in Zone 1 can be increased depends upon the ability of the moose and habitat resource to withstand such activity. In the following

¹ Projections are made of the number of resident hunters up to 1973 in the next chapter.

chapter the potential for moose hunting activity, as dictated by the harvestability of moose populations in the Zone, is assessed.

CHAPTER V

POTENTIAL MOOSE HUNTING ACTIVITY IN ZONE 1

The foregoing analysis indicates that an expansion in Zone 1 moose hunting activity will result in an increase in net social benefits from such activity. However, certain constraints are imposed on expansion of hunting activity in the zone.

Constraints

The first constraint imposed on expansion of Zone 1 moose hunting activity is the biological limitation of the species. While controlled harvest of wildlife populations may improve herd viability to an extent that subsequent harvestable numbers increase, hunting pressure can reach a point where both standing populations and harvest rate decrease. If so, the future flow of net benefits derived from the resource would be reduced.

The second constraint imposed on potential increases in hunting activity is the priority given by the provincial government to resident hunter interests over those of non-residents. Only potential harvestable moose populations beyond those required by resident hunters are available to non-residents.

In the following section estimates of potential harvestable Zone 1 moose populations are presented. Resident hunting activity in the zone and the number of moose required to support that activity are projected and the residual harvestable moose populations available to non-resident hunters determined.

Potential Moose Harvest

Provided the kill is evenly distributed, wildlife biologists estimate a moose population can support an annual hunter harvest of 25 percent of the average yearly population.¹ Estimates of standing moose populations by region in Zone 1 were compiled by Regional Fish and Wildlife biologists. These estimates were obtained by counting animals sighted when flying straight transect lines with fixed-wing aircraft and extrapolating for areas not flown over. Biologists report that estimates obtained by this method are generally conservative as some animals may not be sighted. However, more liberal estimates of Zone 1 moose populations cannot be documented.²

¹ This proportion was arrived at in consultation with Mr. Gordon Kerr, Chief Wildlife Biologist, Fish and Wildlife Division, Alberta Department of Lands and Forests.

² Estimates used in this study of moose densities by Wildlife Management Unit within Zone 1 are listed in the appendix.

Estimated moose populations and annual harvest potential by areas within Zone 1 (Figure 2) are presented in Table 11. The Zone contains approximately 105,000 square miles of moose habitat populated at an average density of 0.60 moose per square mile or an estimated total of 63,265 animals. Areas of high moose density are located generally south of the dotted line in Figure 2. The potential annual harvest is approximately 16,000 moose. While the entire Zone has the potential to support an annual harvest well beyond the 1968 level of 8,657, the surplus is not distributed evenly throughout the Zone. The Southern portion (areas 1, 2, 3, 4, and 7), is currently being harvested close to full potential. Approximately 92 percent of harvestable surplus is located in the remaining areas, that is, areas 5, 6, and 8 (Figure 2 and Table 11).

Projected Resident Hunting Activity

No data are available with which to establish historical trends in the yearly number of resident Zone 1 moose hunters. However, such data are available for total resident big game hunters. For the eighteen years from 1949 to 1966, inclusive, the province issued one resident license per hunter for all antlered game (Table 12). No additional licenses were available for individual antlered species in

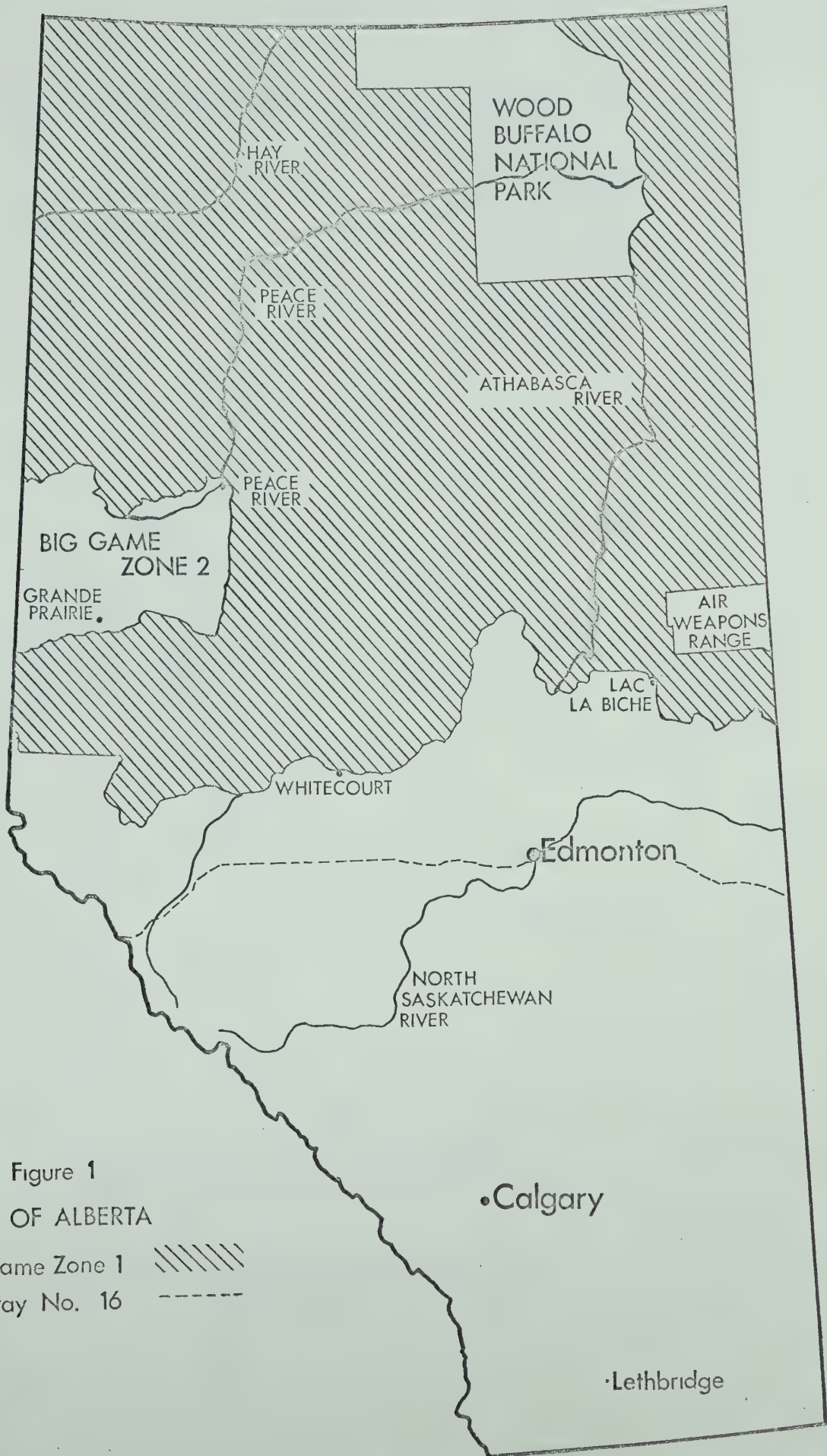


Figure 1

MAP OF ALBERTA

Big Game Zone 1



Highway No. 16



Table 11

ESTIMATED ZONE 1 MOOSE POPULATIONS AND CURRENT AND POTENTIAL HARVEST

Area ^a	Size (square miles)	Moose per Square mile	Total Moose	Potential Harvest		Total 1968 Harvest		Harvestable Surplus	
				Number	Percent of Population	Number	Percent of Population	Number ^b	Percent of Population
1	3,600	1.23	3,240	810	25.0	933	28.8	-123	--
2	2,950	1.67	5,611	1,403	25.0	1,086	19.4	317	5.6
3	1,460	1.27	1,854	463	25.0	673	36.3	-210	--
4	7,560	1.67	14,487	3,622	25.0	3,031	20.9	591	4.1
5	23,087	0.57	13,133	3,283	25.0	1,172	8.9	2,111	16.1
6	29,060	0.28	8,240	2,060	25.0	383	4.6	1,677	20.4
7	3,780	0.60	2,200	550	25.0	564	25.6	-14	--
8	33,498	0.43	14,500	3,625	25.0	815	5.6	2,180	19.4
Total	104,995	0.60	63,265	15,816	25.0	8,657	13.7	7,159	11.3

^a See Figure 2.

^b Negative figures indicate overharvest.

Table 12

ALBERTA POPULATION AND RESIDENT BIG GAME LICENSES ISSUED:
1949 - 1966

Year	Alberta Population (thousands)	Number of Resident Big Game Licenses Issued
1949	885.0	15,279
1950	913.0	12,732
1951	939.5	14,340
1952	973.0	19,862
1953	1,012.0	6,198 ¹
1954	1,057.0	8,747
1955	1,091.0	24,858
1956	1,123.1	27,650
1957	1,164.0	33,268
1958	1,206.0	45,379
1959	1,248.0	46,986
1960	1,291.0	62,116
1961	1,332.0	59,227
1962	1,369.0	67,566
1963	1,403.0	64,809
1964	1,430.0	58,581
1965	1,450.0	41,748
1966	1,463.2	48,039

SOURCES: Population - Canada Dominion Bureau of Statistics, Population 1921-1966 (Ottawa: Queen's Printer, 1968), pp. 36-53.

Licenses - Alberta Department of Lands and Forests, Annual Reports (Edmonton: Alberta Department of Lands and Forests, 1949-1966).

any of these years which means that license sales are equal to the actual number of resident big game hunters. Based on the hypothesis that the number of hunters is largely a function of total population, the following regression equation was estimated to predict future Zone 1 resident hunter participation:

$$X_1 = -74149.50933 + 0.09331X_2; R^2 = 0.763; \\ (0.013)$$

where X_1 represents the number of Alberta resident big game hunters and X_2 represents the Alberta population.¹

This equation was used to predict the number of resident big game hunters from 1969 through 1973 on the basis of projected Alberta population estimates for the same years (Table 13). The prediction of numbers of Zone 1 resident moose hunters for the same period is made on the assumption that the zone's 1968 proportion of all resident big game hunters will remain constant through 1973. Projected resident hunter moose kills are based on a success rate of 35 percent assumed to prevail through 1973.² Annual Zone 1

¹ The bracketed standard error is such that the slope coefficient of 0.09331 is significantly different from zero at the 0.5 percent level of confidence. Seventy-six percent of the variation in X_1 is explained by X_2 .

² The assumed success rate is slightly higher than the 1968 rate of 30.7 percent. During the 1968 season adverse weather conditions were more prevalent than normal.

Table 13

ALBERTA POPULATION, TOTAL RESIDENT BIG GAME HUNTERS, RESIDENT ZONE 1

MOOSE HUNTERS, AND ZONE 1 MOOSE HARVEST: PROJECTED TO 1973

Year	Projected ^a Alberta Population	Predicted ^b Number of Resident Big Game Hunters	Percent Change in Hunters over Previous Year	Predicted ^c Number of Zone 1 Moose Hunters	Projected Number ^d of Moose Killed in Zone 1 by Resident Hunters
1968	1,530,900	68,699	--	21,470	--
1969	1,564,700	71,853	4.5910	22,456	7,860
1970	1,598,500	75,007	4.3895	23,442	8,205
1971	1,632,300	78,160	4.2036	24,427	8,549
1972	1,666,200	81,160	3.8382	25,365	8,878
1973	1,700,000	84,477	4.0870	26,402	9,241

^a Source of population projections: W.M. Schultz, "The Population - 1901, Today and in 1998," Alberta Conference on Aging, Edmonton, November 15, and 16, 1967, (mimeo.).

^b The number of resident big game hunters is projected using the formula,
 $X_1 = -74149.5 + 0.0933IX_2$ where $\bar{X}_1$ = number of hunters and X_2 = Alberta population.

^c The number of Zone 1 moose hunters is projected on the assumption that the percent yearly increase (starting from 1968 when the number was known) equals the corresponding increase in the total number of big game hunters.

^d A 35 percent success rate is assumed in projecting resident hunter moose harvest.

moose harvests by resident hunters are expected to increase to 9,241 animals by 1973.

The distribution of the predicted increase in resident hunter harvest among the eight areas within Zone 1 is based on a proportional increase in kill for each area equal to that of the Zone overall.

Potential for Non-resident Hunting Activity

Area predictions of resident hunter harvest are deducted from potential annual moose harvest for each area to determine the expected annual number of moose available for harvest by non-resident hunters. The number is expected to decline from 7,611 moose for 1970 to 6,575 for 1973 (Table 14).¹ Therefore, approximately 14,000 non-resident hunters per year may be accommodated at a success rate of 50 percent.² However, distribution of the surplus moose within the Zone is such that over 75 percent of non-resident hunters who can be accommodated are restricted to the northern areas. The southern

¹ The projections for areas 5, 6, and 8 may be oversimplified, since a portion of the harvestable number not taken in any one year will carry over into subsequent years. However, a lack of information on population dynamics and particularly herd recruitment precludes further elaboration.

² During the 1968 season, the non-resident success rate was 41.3 percent (Table 1).

Table 14

RESIDENT HUNTER ZONE 1 MOOSE HARVEST, POTENTIAL TOTAL HARVEST,
AND SURPLUS AVAILABLE TO NON-RESIDENTS: PROJECTED TO 1973

Area	Projected Resident Hunter Moose Harvest					Potential Annual Moose Harvest	Moose Available For Harvest to Non-resident Hunters			
	1968 ^a	1970	1971	1972	1973		1970	1971	1972	1973
1	691	826	860	894	930	810	-16	-50	-84	-120
2	802	959	999	1,037	1,080	1,403	444	404	366	323
3	602	719	750	778	810	463	-256	-287	-315	-347
4	2,519	3,010	3,137	3,258	3,391	3,622	612	485	364	231
5	802	959	999	1,037	1,080	3,283	2,324	2,284	2,246	2,203
6	312	373	388	404	420	2,060	1,687	1,672	1,656	1,640
7	379	453	472	490	510	550	97	78	60	40
8	758	906	944	980	1,020	3,625	2,719	2,681	2,645	2,605
Total	6,865	8,205	8,549	8,878	9,241	15,816	7,611	7,267	6,938	6,575

^a 1968 figures are actual harvest.

portion of the Zone (areas 1, 2, 3, 4, and 7), can support approximately 1,600 non-resident hunters annually through 1971. By 1975 the number of resident hunters in these areas is expected to have increased to approximately 19,500. At this level non-resident hunters can no longer be accommodated unless habitat carrying capacity is substantially increased.¹

Conclusion

The moose resources of Zone 1 as a whole are currently underutilized (Table 11). Therefore, potential exists for a substantial increase in moose hunting activity in the zone. To the extent that net social benefits are directly a function of the number of resident and non-resident hunters (as discussed at the conclusion of Chapter IV), increases in moose hunting activity will produce increased social net benefits. That is, the direction of change in hunting activity required to maximize net social benefits from that activity is toward greater utilization.

However, the moose in some areas within Zone 1 are currently being utilized at, or close to full potential. Therefore, the increase in net benefits depends ultimately upon implementation of policy to insure a spatial shift of hunting activity within Zone 1 to a distribution more

¹The population of Alberta in 1975 is expected to be 1.8 million individuals. Using the prediction equation, the estimated number of resident big game hunters for that year is 91,376. Approximately 19,500 of the latter will hunt moose in the southern portion of Zone 1.

compatible with area harvestability. Given resident hunter priority, reorientation of hunting activity to the northern or relatively inaccessible portions of Zone 1 can be accomplished most readily through changes in regulations governing non-resident hunting. Redistribution of non-resident hunting activity may be insured directly through the imposition of quotas or license sales by area within the Zone, or indirectly (given retention of mandatory guiding services for non-residents) through manipulation of the guiding system.

From the viewpoint of Alberta there appears to be large potential for realizing increased benefits from non-resident hunting activity with little additional costs required. Some of the extra-market benefits now received by non-resident hunters may be appropriated by the province through increased hunting license fees or, given retention of mandatory guiding, through increased payments by non-residents for guiding services. The extent by which such benefits may be appropriated is not known. However, if the present increase in world population and decrease in available wildlife for recreation continues, the number of non-residents desiring to hunt Zone 1 moose will likely increase significantly in the future. Willingness to pay for hunting licenses and associated goods and services should also increase.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Two objectives are established in the introductory chapter of this study. The first is to evaluate Zone 1 moose resources from the viewpoint of society in general and of Alberta and Northern Alberta in particular. The second objective is to determine the direction of future utilization of moose resources in the zone, consistent with the objective of conservation policy, i.e. maximization of the present value of the future flow of annual net social benefits. In answer to the first objective, the following results are obtained. Zone 1 moose resources, through support of hunting activity alone, currently provide an estimated 0.75 millions of dollars annual net social benefits to society in general, approximately 1.46 millions of dollars annually to the Province of Alberta, and 1.48 millions annually to Northern Alberta. These resources also contribute other benefits recognized but not measured in this study. For example, tourists gain enjoyment from wildlife. Some people who do not hunt moose gain benefits from the knowledge that the opportunity to do so is open to them, their friends, or their posterity. Further consideration is

required to meet the second objective.

The moose resources of Zone 1 as a whole are currently underutilized and, therefore, can support increased hunting activity. The nature of associated benefits and costs suggests that an expansion in such activity would produce increased annual net social benefits. That is, the direction of change in Zone 1 moose hunting activity consistent with conservation policy is toward greater utilization. However, the distribution within Zone 1 of current hunting pressure and moose harvest in relation to available moose populations is such that optimum utilization of the moose resources will require expansion of hunting activity favoring some areas of the zone more than others. Current priority given to resident over non-resident hunters is expected to continue and has implications concerning the distribution of future non-resident hunting activity. Continued growth in the annual number of resident moose hunters may, if its distribution is unchanged, preclude non-resident hunting in southern areas of the Zone within several years.¹

The 1967 experience of the Alberta Fish and Wildlife Division demonstrates the effectiveness of methods such as

¹ If moose populations are found to be higher than current estimates indicate, the southern areas of Zone 1 will be able to accommodate non-resident hunters for a longer period of time than predicted in this study.

advertising in promoting increased non-resident hunter participation.¹ Under no circumstances should such methods be employed unless adequate measures are taken to ensure distribution of hunting activity, particularly that of non-resident hunters, to areas with sufficient potential moose harvest. Such measures might include area hunting license quotas or, given retention of mandatory guiding, manipulation of the guiding system. This shift of hunting pressure is prerequisite to full moose resource utilization consistent with the objective of maximizing annual social net benefits to society at large and particularly to the people of Alberta in the foreseeable future.

Provided redistribution of overall hunting activity within Zone 1 takes place, there is little likelihood of reaching the full potential of moose resource utilization for some years. However, some time in the future two developments are likely to take place. First, moose habitat and consequently hunting quality may decrease through increasing alternative public land uses to the extent that net social benefits from moose hunting activity are either decreased or prevented from increasing.

¹ Supra., page 3.

Second, considerable outlays of public funds for such things as habitat improvement may be proposed to increase social benefits from moose hunting activity or at least to prevent a decrease in these benefits. With respect to the first development, the social benefits to be derived from alternative uses of the resources must be compared with those foregone by preclusion of moose hunting activity. With respect to the second net social benefits resulting from habitat improvement must be compared with returns from alternative uses of limited public funds.

This study provides necessary but not sufficient information for economic comparison of alternative uses of wildlife habitat. Wildlife resources contribute benefits to society in addition to those evaluated here. All benefits and costs, even if quantification is not possible, should be carefully considered before public policy decisions are reached that will effect wildlife and wildlife habitat resources. Further study of all alternative resource uses is necessary to determine optimum resource utilization in Zone 1. Such further study will become increasingly urgent as rising competition for limited available land prevents further expansion of hunting activity without addition to existing moose habitat or expansion of existing habitat carrying capacity.

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APPENDIX A
HUNTER SURVEY MATERIAL

Letter Accompanying Mail Questionnaire

TELEPHONE NO. 229-4461



PLEASE QUOTE FILE NO.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

NATURAL RESOURCES BUILDING

109TH STREET AND 99TH AVENUE

EDMONTON, ALBERTA

Dear Sportsman:

We are attempting to assess the economic impact of the 1968 special Big Game Zone 1 moose season and get some insight as to how it may be handled in future years.

You have been selected as one of several hundred hunters to furnish information on your 1968 hunt(s) in Big Game Zone 1. This information will help us estimate the worth of our wildlife resources and compare Big Game hunting with alternative land uses.

We would greatly appreciate your taking a few minutes of your time to fill out the enclosed questionnaire and return it to us at your earliest convenience. Your information is needed EVEN IF YOU HUNTED VERY LITTLE OR WERE UNSUCCESSFUL.

Please do not sign your name and be assured that all information will be held in strict confidence. Thank you for your cooperation.

Yours sincerely,


S. B. Smith,
Director of Fish and Wildlife.

Encl.

Follow-up Letter: Mail Survey

TELEPHONE NO.

229-4461



PLEASE QUOTE FILE NO.

GOVERNMENT OF THE PROVINCE OF ALBERTA

DEPARTMENT OF LANDS AND FORESTS

NATURAL RESOURCES BUILDING

109TH STREET AND 99TH AVENUE

EDMONTON, ALBERTA

Postal Zone 6

Dear Sportsman:

A few weeks ago we sent you a questionnaire requesting information on any moose hunting you may have done in Big Game Zone 1 during the 1968 season.

If you are one of the many who have already completed and returned the questionnaire, please disregard this letter and accept our sincere thanks for your co-operation.

If you have not returned the questionnaire, could you please do so as soon as possible? Please note that the information is needed even if you bought a license but DID NOT HUNT IN B.G. ZONE 1 OR WERE UNSUCCESSFUL.

Yours sincerely,

A handwritten signature in dark ink, appearing to read 'S. B. Smith'.

S. B. Smith,
Director of Fish and Wildlife.

Non-resident Hunter Questionnaire

NON-RESIDENT HUNTERS

Note: If you have been personally interviewed for this information, please check here ☐ and return the questionnaire.

A. TRAVEL INFORMATION

1. Residence

(city or town) _____ (province or state) _____

2. What mode of transportation did you use? (check which)

Plane	Car	Camper or Pickup	4-wheel Drive	Other (specify)
From your home to the hunting area				
In the hunting area				

3. Briefly outline the route you took from your home to the hunting area and return. _____

How many days were you away from home? _____

4. How many days did you spend in Alberta? _____

5. How many days did you actually hunt in Alberta? _____

6. Where did you hunt in Alberta? _____
(nearest town or landmark)

7. What overnight accommodation did you use in Alberta? _____

B. HUNTING INFORMATION

1. Did you PERSONALLY shoot and tag a moose? Yes ☐ No ☐2. If so, which? Bull ☐ Cow ☐ Calf ☐

Date of kill: Sept. ☐ Oct. ☐ Nov. ☐ Dec. ☐

Location of kill: _____
(nearest town or landmark)

Do you plan to have the skin tanned? Yes ☐ No ☐

3. How many years have you hunted Big Game? _____

4. How many years have you hunted moose? _____

5. Have you hunted moose previously in Alberta? Yes ☐ No ☐

6. If yes, where and when? _____

7. What other places have you hunted moose? _____

8. Did you hunt birds or go fishing in Alberta this trip? Yes ☐ No ☐9. If yes, which? Upland birds ☐ Waterfowl ☐ Fish ☐

Did you do this at the same time as you hunted moose? Yes ☐ No ☐

10. Based on your past hunting experience, what is your overall rating of the moose hunting in the special area you hunted this trip?

Excellent ☐ Good ☐ Average ☐ Poor ☐ Very Poor ☐

11. Which Alberta licenses did you hold this year other than moose (if any)?

Angling ☐ Game Bird ☐ Whitetail Deer ☐

12. How would you rate your degree of satisfaction with the following aspects of your hunt in Alberta? (please check)

	Excellent	Good	Average	Poor	Very Poor
Information on the hunting areas					
Access to the hunting areas					
Guiding services					
Facilities for buying equipment					
Facilities for buying licenses & permits					
Sleeping and eating accommodation					
License fees					
Other (please specify)					

C. EXPENDITURE INFORMATION

IMPORTANT - list only your own personal expenses and include those for your entire return trip.

Approximately how much money did you spend on the following items?

		Within Hunting Area i.e. North of Edmonton	Elsewhere in Alberta	Outside Alberta
RENTALS-	U-Drive car or truck			
	Accommodation trailer			
	Utility trailer			
	Power toboggan			
	Other (please specify)			
	Overnight lodging			
	Restaurant meals			
	Food other than restaurant			
	Alcoholic beverages			
	Gasoline and motor costs			
	Bus, plane or train fare			
	Guiding services			
	Clothing			
	Hunting and camping equipment			
	Arms and ammunition			
	Cameras and film			
	Miscellaneous			

- 3 -

D. GENERAL INFORMATION

1. Yearly family income (include all income of entire family) _____
2. Occupation _____. Marital status _____
3. Age ____ Education _____
(highest grade or degree completed)
4. Was your hunting trip a vacation with pay? Yes ☐ No ☐ Partially ☐
If yes or partially, how many days? _____
Was it a leave of absence? Yes ☐ No ☐ Partially ☐
If yes or partially, how many days? _____
5. Was hunting the sole purpose of your visit? Yes ☐ No ☐
If not, please specify _____
6. How many people were in your party? _____
7. How did you find out about moose hunting in Alberta? _____
8. Was your guide either all or part Indian? Yes ☐ No ☐
9. How many days vacation do you get per year? _____ days.
10. Before deciding to come here for moose, did you consider going to other big game areas? Yes ☐ No ☐ If yes, which ones? _____

11. Do you plan to return to Alberta for (check which): hunting moose ☐
hunting other Big Game ☐ other hunting ☐ fishing ☐ other outdoor recreation ☐
12. What is the most important reason why you hunt Big Game? _____

13. This question is asked to enable you to tell us what you think our land resources are worth when preserved for wildlife.
Do you consider the total benefits you received from your hunt this year to be worth more than they cost you? Yes ☐ No ☐
If yes, how much more? (check one) 0-10% ____, 10-25% ____, 25-50% ____, 50-75% ____, 75-100% ____, more than 100% ____.
Have you any additional remarks that may help us in evaluating the special moose season? _____

Resident Hunter Questionnaire

RESIDENT HUNTERS

If you DID NOT hunt moose in Big Game Zone 1, check here ☐ and return the questionnaire.
If you DID hunt moose in Big Game Zone 1, please complete the remainder of the questionnaire.

A. TRAVEL INFORMATION

1. Residence (city or town) _____
2. What type of transportation did you use? (check which)

From your home to the hunting area In the hunting area	Plane	Car	Camper or Pickup	4-Wheel Drive	Other (Specify)

3. How many days did you hunt moose in Big Game Zone 1? _____
4. Where did you hunt in Big Game Zone 1? _____
(nearest town or landmark)

B. HUNTING INFORMATION

1. Did you PERSONALLY shoot and tag a moose?
Yes ☐ No ☐
2. If so, which? Bull ☐ Cow ☐ Calf ☐
Date of kill: Sept. ☐ Oct. ☐ Nov. ☐ Dec. ☐
Location of kill: _____ (nearest town or landmark)
Do you plan to have the skin tanned? Yes ☐ No ☐
3. How many years have you hunted Big Game? _____
4. How many years have you hunted moose? _____
5. Have you hunted previously in Big Game Zone 1? Yes ☐ No ☐
6. If yes, when? _____
7. What other places have you hunted moose? _____
8. Based on your past hunting experience, what is your overall rating of the moose hunting in the special area you hunted this season?
Excellent ☐ Good ☐ Average ☐ Poor ☐ Very Poor ☐
9. Which Alberta licences did you hold this year?
Angling ☐ Bird Game ☐ Mule Deer ☐ Whitetail Deer ☐ Moose ☐
Elk ☐ Caribou ☐ Goat ☐ Trophy Sheep ☐ Non-trophy Sheep ☐
Grizzly Bear ☐ Special Zone 1 Moose ☐

C. EXPENDITURE INFORMATION

IMPORTANT: List only your own personal 1968 expenses for hunting trips you made to Big Zone 1.

Approximately how much money did you spend on the following items?

	North of Edmonton	Edmonton & South
RENTALS		
U-Drive car or truck	\$	\$
Accommodation trailer	\$	\$
Utility trailer	\$	\$
Power Toboggan	\$	\$
Other (please specify)	\$	\$
Overnight lodging	\$	\$
Restaurant meals	\$	\$
Food other than restaurant	\$	\$
Alcoholic beverages	\$	\$
Gasoline and motor costs	\$	\$
Clothing	\$	\$
Hunting and camping equipment	\$	\$
Arms and ammunition	\$	\$
Cameras and film	\$	\$
Miscellaneous	\$	\$

D. GENERAL INFORMATION

1. Approximate yearly family income before taxes (include all income of entire family) \$ _____
2. Occupation _____ Marital status _____
3. Age _____ Education (highest grade or degree completed) _____
4. Did you spend any of a paid vacation hunting? Yes ☐ No ☐
If so, how many days? _____
5. Did you take a leave of absence from work to hunt? Yes ☐ No ☐
If so, how many days? _____
6. What is the most important reason why you hunt Big Game? _____
7. This question is asked to enable you to tell us what you think our land resources are worth when preserved for wildlife.
Do you consider the total benefits you received from your hunt this year to be worth more than they cost you? Yes ☐ No ☐
If yes, how much more? (check one) 0-10% _____, 10-25% _____, 25-50% _____, 50-75% _____, 75-100% _____, more than 100% _____
If you have any additional remarks that may help us in evaluating the impact of the special moose season, please use the back of this page.

APPENDIX B
MISCELLANEOUS TABLES

Table 1

ESTIMATES OF ZONE 1 MOOSE POPULATIONS
BY WILDLIFE MANAGEMENT UNIT^a

Location ^b	W.M.U.	Area (sq. miles)	Density (Moose per sq. mile)	Total Moose
1	F356	3,600	1.23	3,240
2	F354	2,950	1.67	5,611
3	F352	1,460	1.27	1,854
4	F350	7,560	1.67	14,487
5	M524	6,980	0.87	6,070
5	M526	5,107	1.06	5,413
5	M536 & M538	11,000	0.15	1,650
6	M520	6,190	0.47	2,910
6	M528	9,250	0.37	3,420
6	M534	13,620	0.14	1,910
7	M511	3,780	0.60	2,200
8	M514	1,512	1.40	2,000
8	M512	6,336	1.00	6,300
8	M518	19,800	0.30	5,900
8	M530	2,160	0.05	100
8	M532	3,690	0.05	200
Total, Zone 1		104,995	0.60	63,265

^a Wildlife Management Units (W.M.U.'s) are defined by the Alberta Fish and Wildlife Division. Estimates of moose populations were provided by the following Fish and Wildlife Biologists: Mr. G. Kemp (St. Paul Region), Mr. T. Burgess (Peace River Region) and Mr. G. Lynch (Edson Region).

^b Location by areas described in Figure 2.

Table 2

CHRONOLOGY AND CLASSIFICATION OF
REPORTED MOOSE KILL: 1968, ZONE 1

Month of Kill	Number of Moose Killed ^a					Percent of Total Kill
	Bulls	Cows	Calves	Unclassified	Total	
September	81	35	8	6	130	29.0
October	72	50	10	5	137	30.5
November	57	48	11	5	121	26.9
December	28	27	4	2	61	13.6
Total	238	160	33	18	449	100.0

^a The total reported kill does not equal the total number of successful respondents to the questionnaire as some resident hunters possessing both licenses killed two moose.

Table 3

AREA DISTRIBUTION OF REPORTED MOOSE KILL: 1968, ZONE 1

Area Hunted ^a	Number of Moose Killed ^b				Total	Percent of Area Kill			
	Bull	Cow	Calf	Unclas- sified		Bull	Cow	Calf	Uncl.
1	25	18	2	3	48	52.1	37.5	4.2	6.2
2	30	23	2	1	56	53.6	41.1	3.6	1.8
3	17	11	1	3	32	53.1	34.4	3.1	9.4
4	82	47	14	6	149	55.0	31.5	9.4	4.0
5	32	26	3	1	62	51.6	41.9	4.8	1.6
6	11	7	1	0	19	57.9	36.8	5.3	1.6
7	14	8	6	2	30	46.7	26.7	20.0	6.7
8	20	13	3	2	38	52.6	34.2	7.9	5.3
Unspecified	7	7	1	0	15	46.7	46.7	6.7	0.0
Total	238	160	33	18	449	53.0	35.6	7.3	4.0

^a See Figure 2, page 79.

^b See footnote, Table 2, page 49.

Table 4

HUNTER EVALUATION: OVERALL ZONE 1
MOOSE HUNTING QUALITY, 1968

Rating	Percentage of Hunters Expressing Opinion		
	Non-resident Hunters	Non-local Hunters	Local Hunters
Excellent	21	13	28
Good	37	35	34
Average	22	27	23
Poor	11	24	5
Very Poor	9	1	9

Table 5

AREA COMPARISON: HUNTER EVALUATION OF
MOOSE HUNTING QUALITY, 1968

Area ^a	Percentage of Hunters Expressing Opinion				
	Excellent	Good	Average	Poor	Very Poor
1	22	30	34	10	4
2	26	35	22	11	6
3	12	24	33	23	8
4	14	31	35	12	8
5	14	43	25	12	6
6	21	33	23	13	10
7	10	34	36	13	7
8	13	38	30	10	9

^a See Figure 2, page 79.

Table 6

AVERAGE TOTAL SEASON EXPENDITURES BY HUNTER AND
EXPENDITURE CATEGORY: 1968 ZONE 1 MOOSE HUNTERS^a

Expenditure Category	Hunter Category		
	Local Residents	Non-local Residents	Non-Residents
Equipment rental	4.21	3.88	7.13
Overnight lodging	.92	5.89	17.60
Restaurant meals	2.58	9.94	26.83
Food other than restaurant	10.63	15.52	20.54
Alcoholic beverages	3.16	5.91	9.85
Gasoline and motor costs	29.29	36.64	68.59
Bus, plane, or train fares	--	--	5.23
Guiding services	--	--	101.30
Clothing	8.00	10.67	6.18
Hunting and Camping Equipment	15.82	21.24	4.22
Arms and ammunition	31.56	35.06	2.86
Cameras and film	2.93	2.54	2.47
Hunting licenses	5.78	5.73	52.00
Miscellaneous	6.10	7.49	21.21
Total	120.98	160.51	346.10

^a Weighted for success factor (unsuccessful respondents given 1.5 times more weight than successful).

Table 7

NON-RESIDENT QUESTIONNAIRE RESPONDENTS
BY STATE OF RESIDENCE

State of Residence	Number of Respondents	Percent of Total Respondents
Washington	138	53.9
Oregon	32	12.5
California	23	9.0
Montana	15	5.9
Idaho	10	3.9
Others	38	14.8
Total	256	100.0

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